THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LX. No. 1524.] LONDON, JULY 26, 1892. [44TH YEAR. PRICE 6d.

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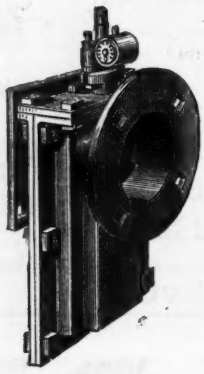

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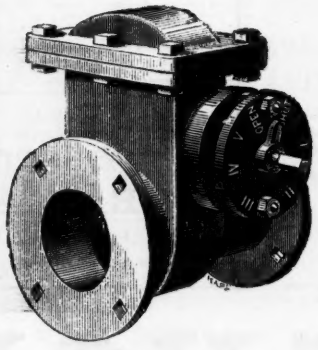

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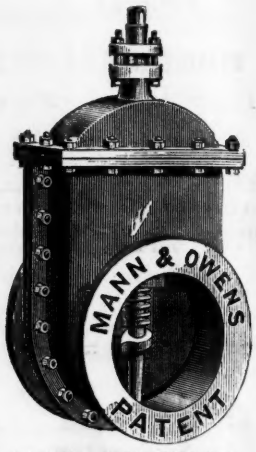

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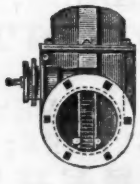

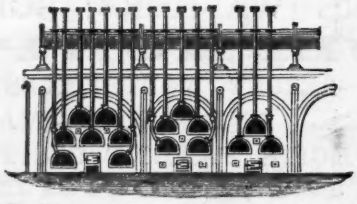

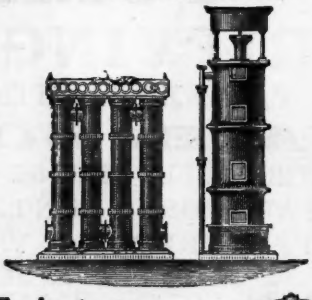

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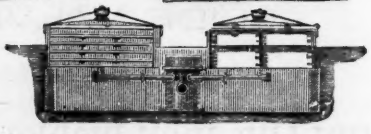

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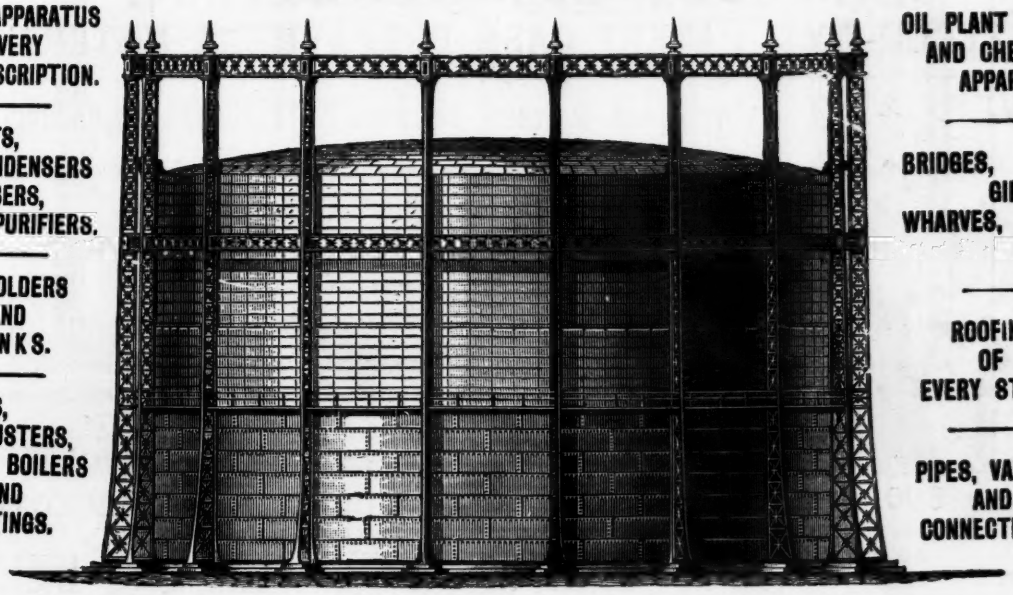

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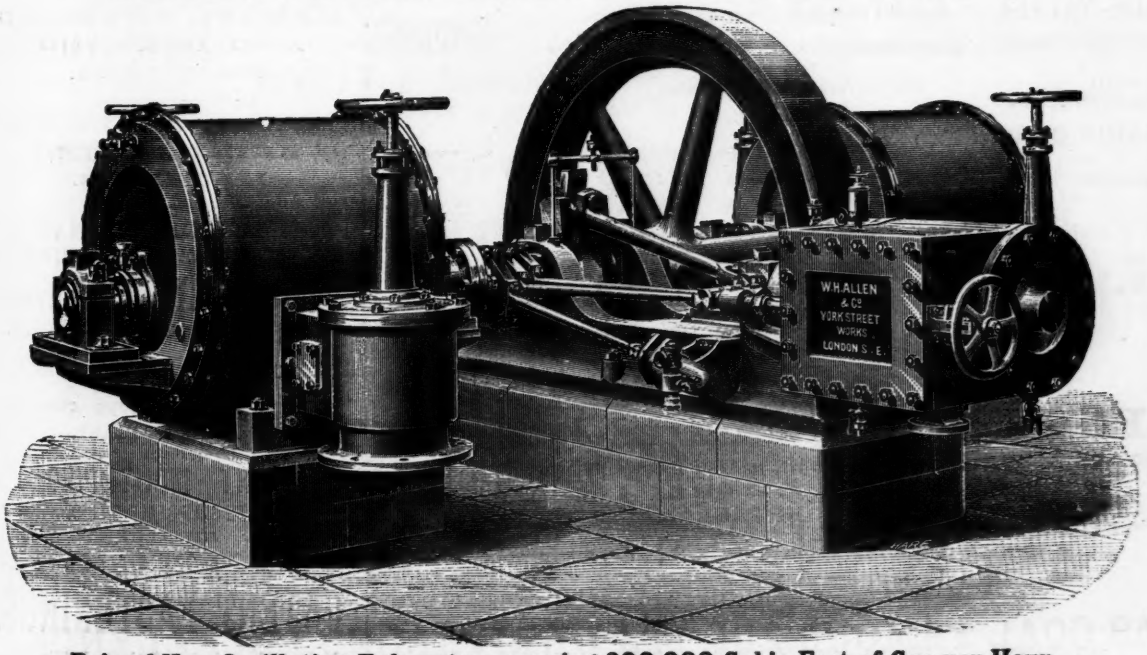

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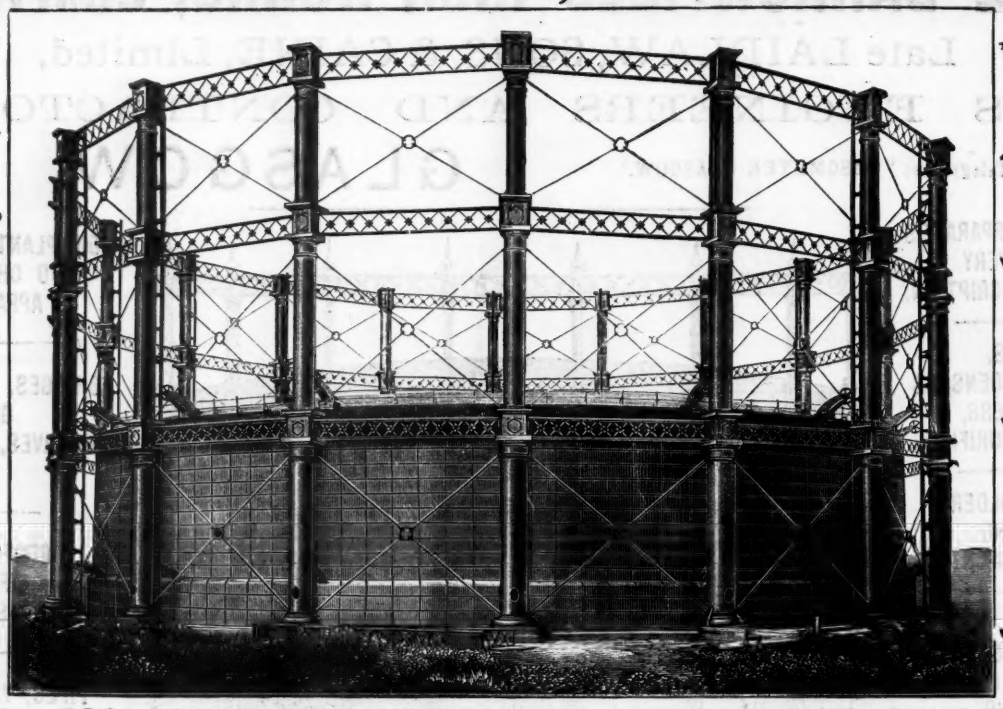

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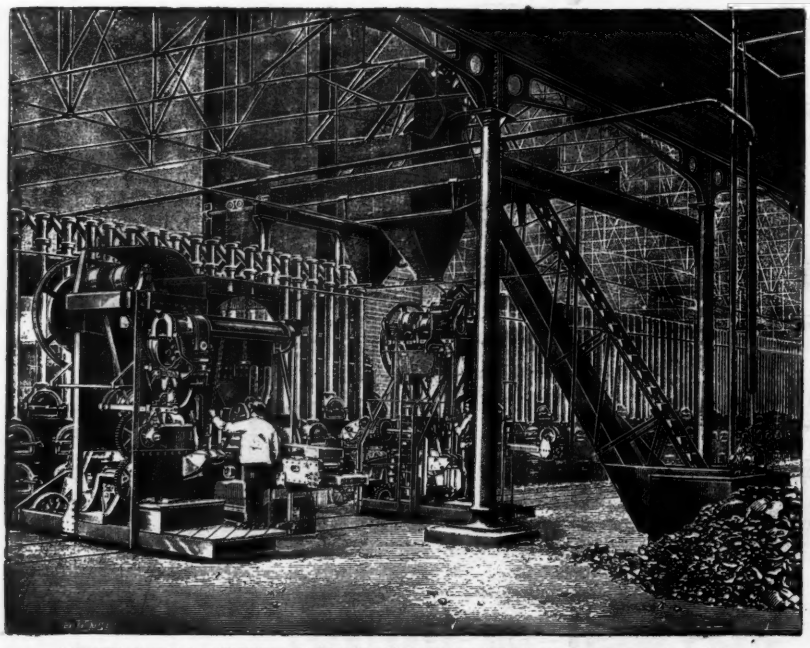

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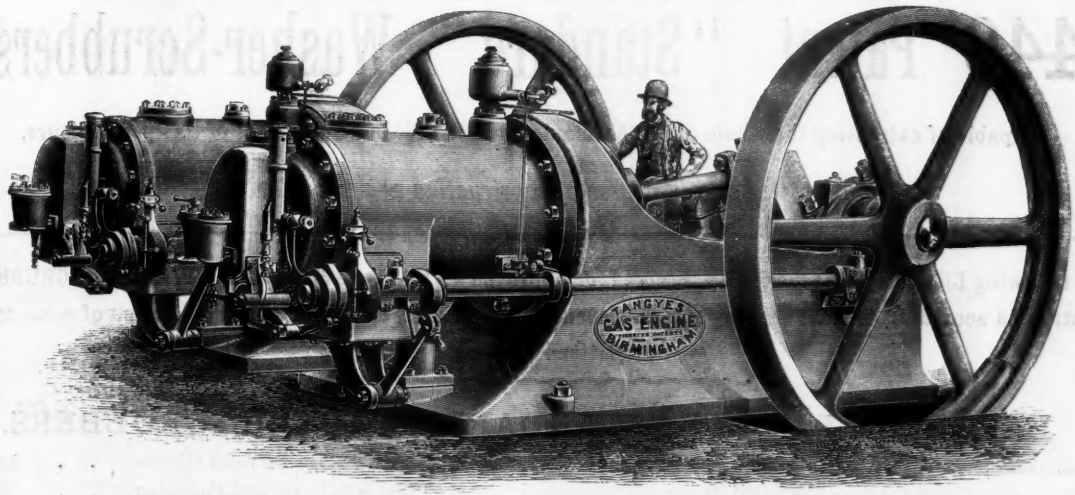

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,,	3,500,000	Colchester	1,000,000	Workington	500,000
Kensal Green	3,000,000	Cambridge	1,000,000	Lowestoft	500,000
,,	3,000,000	West Bromwich	1,000,000	Newton-le-Willows	500,000
Liverpool	3,000,000	Luton	1,000,000	Manchester	400,000
,,	3,000,000	Alger (Algieria)	875,000	Erfurt (Germany)	400,000
Croydon	3,000,000	Valencia (Spain)	875,000	St. Chamond (France)	350,000
West Ham	3,000,000	Barcelona (Spain)	875,000	Santander (Spain)	350,000
Rochdale	3,000,000	Nice (France)	875,000	Atlas Steel Works, Sheffield	250,000
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,,	3,000,000	Magdeburg (Germany)	750,000	Lille (France)	250,000
Glasgow	2,500,000	Altoona (U.S.A.)	750,000	Melun ,,	210,000
,,	2,500,000	Smethwick	750,000	Valencia (Spain)	200,000
Manchester	2,500,000	Schneider-Creusot Works		,, ,,	200,000
Leicester	2,250,000	(France)	735,000	Vercelli (Italy)	200,000
Swansea	2,000,000	Valparaiso (Chili)	600,000	Rawmarsh	200,000
Bordeaux	2,000,000	Halle (Germany)	600,000	Baccarat (France)	175,000
Melbourne	1,500,000	Elberfeld ,,	600,000	Hitchin	150,000
Charlottenburg (Germany)	1,500,000	,, ,,	600,000	Sydney	100,000
Derby	1,500,000	Nancy (France)	525,000	Balson-Chateauroux (France)	70,000
,,	1,000,000	,, ,,	525,000		

RENEWALS.

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Vauxhall ,,	3,000,000	Nottingham	1,500,000	Kingston-on-Hull	400,000
Dublin	3,000,000	Melbourne	1,500,000	Weston-super-Mare (in part)	400,000
Shoreditch (in part)	2,500,000	,,	1,500,000	Enfield	300,000
Beckton	2,500,000	Crewe (L. & N.W.R. Co.)	1,250,000	Harrow	250,000
Manchester	2,500,000	Beckton	1,250,000	Buxton	250,000
Bromley	2,000,000	,, (in part)	1,250,000	Quebec, Canada (in part)	250,000
Pimlico (in part)	2,000,000	Bradford	1,250,000	Newmarket	150,000
Plymouth	2,000,000	Maidstone	1,000,000	Leominster	150,000
Croydon	1,500,000	Smethwick	750,000	Kidsgrove	100,000
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All New Patent "Standard" Washer-Scrubbers are fitted with the Company's Patent Improved Wooden "Bundles" or Washing Devices, which can be readily fitted to old pattern Machines.

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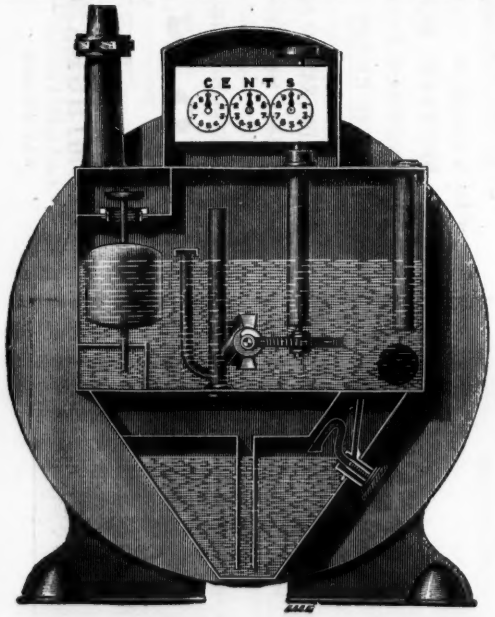
THE SYPHON OVERFLOW

— Wm. Cowan's Patent. —

To suppose, as some do, that the main object of the "Syphon Overflow" is to promote the convenience of inspectors and others who "water" meters, is to misapprehend the chief purpose of the invention. That the convenience of inspectors is promoted by the Syphon Overflow is a fact that admits of no doubt whatever, because the watering of meters is thereby greatly facilitated; but it is a mistake to fix attention upon this result, and to regard it as the only one attained. To do this is to lose sight of the chief purposes the Syphon Overflow was designed to secure.



These purposes were—

1st.—The **speedy** attainment of **exactly the same water line** on each occasion of watering.

2nd.—The **absolute certainty** of this water line being attained.

3rd.—The **impossibility** of any water afterwards finding its way into the waste-box.

The first and second of these conditions secure the interests of the gas company, whilst the third greatly promotes the convenience of the consumer, for reasons that are well known.

Who that has had experience of Wet Meters does not know the disadvantages of the "Low Spout?" The slowness with which it adjusts the water line, and the patience required while this is being done, are matters of every-day experience. It is therefore no wonder that the "Syphon Overflow" is regarded as one of the most important improvements ever made in the Wet Gas-Meter. It is not only an important improvement **in itself,** but it possesses the property of making all previous improvements more valuable and effective. It has, indeed, made the Wet Meter a more perfect, and, in every way, a more satisfactory instrument.

Narrow views as to price often prevent the adoption of real improvements; but it would be a narrow view indeed which would prefer a "Low Spouted" Meter to one with a "Syphon Overflow," because of the trifling difference in the price of the two.

— W. & B. COWAN, —

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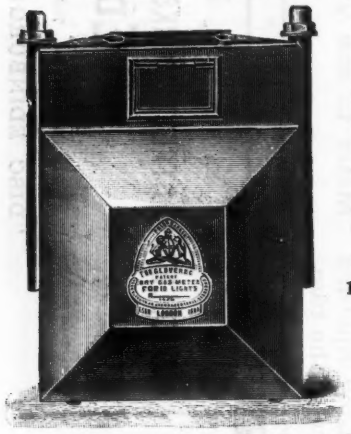

1st.—Are a remedy for all the defects of Wet Meters.
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3rd.—Incur no loss of Gas by Evaporation.
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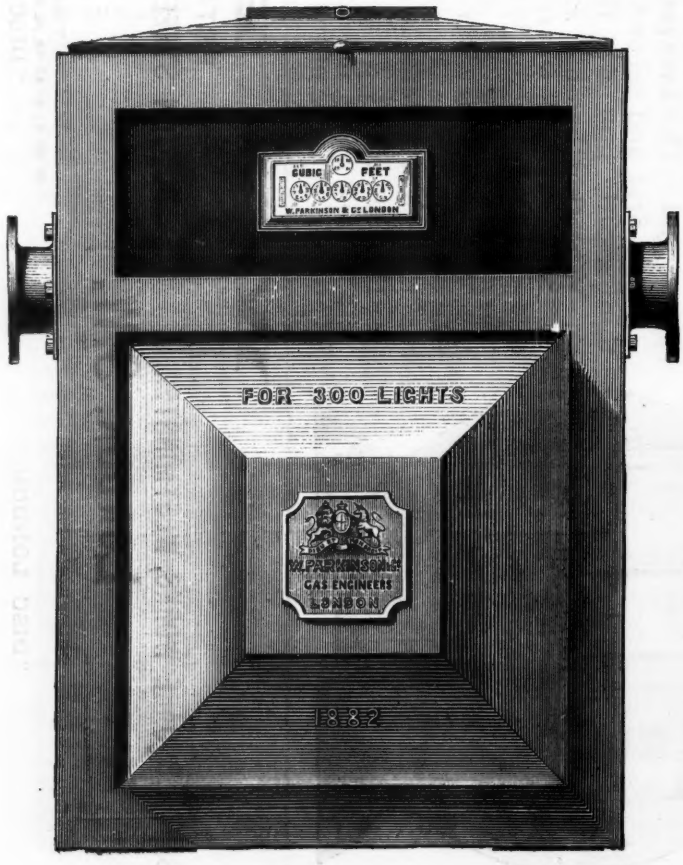

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[See also Advt. p. 184.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 26, 1892.

The Annual Meeting of the Society of Chemical Industry.

THE Society of Chemical Industry held their annual general meeting in London last week, under the presidency of Professor J. Emerson Reynolds. In this Society all the technical work is done at the sectional meetings; and consequently the somewhat peculiar spectacle was presented of one of the youngest, and perhaps most valuable, of the technical associations of the day convening its members to receive the presidential address, the report of the Council, and the statement of accounts for the year, and then giving up the remainder of the three days to excursions and amusements. When it is understood, however, that this general meeting is the only means whereby the members of the Society, who belong for technical work to separate sections of the organization, can be re-united as a whole, and that this is also the only opportunity for "taking stock" of the position and the prospects of the Society, the apparent oddity of the programme vanishes; and it is possible to recognize in it a very well-considered arrangement. Indeed, it is open to argument that the proceedings of some other technical bodies that might be named would be vastly improved by taking a leaf out of the book of the constitution of the Society of Chemical Industry. The address of Professor Emerson Reynolds bore almost exclusively upon a class of subjects in which our readers are peculiarly interested. It dealt, with engaging freshness, with the great question of the fuel supplies of the world, which the speaker divided into the three orders of coal, peat, and petroleum, beside which, as he remarked, no other kinds of fuel need be considered. The author declared that the era of dear coal cannot be far off, both because of the increasing significance of labour disputes, and the growing scarcity of coal itself. Then the question was mooted of what is to be done for fuel in this approaching time. Here Professor Emerson Reynolds, as it seems to us, went a little astray. Condemning the open domestic fire as wasteful and smoky, and the closed variety as "incapable of obtaining a foot-"ing in this country," the speaker proceeded to state that "the only solution of the difficulty is to be found in the "gasification of the fuel before it reaches the consumer." We shall deal with a particular phase of this suggestion in another article; and, for the present, we shall therefore confine our remarks to the general idea. It appears that there is a defective link in Professor Emerson Reynolds's chain of reasoning. It might be possible to agree with his conclusion that gaseous fuel must come; but his statement of the reason for this consummation is weak. He dismisses the economical close stove as a possible intermediary between the open coal-fire and the gas-stove, with the single remark that it does not recommend itself in this country. Why is this? Unquestionably, for the main reason that coal is too cheap. Let the average price of house coal rise all over the United Kingdom by 10s. per ton, and we should soon see a weakening in the Briton's proverbial love for his blazing, smoky "sea-coal" fire. The tendency in this direction has already shown itself in the great and growing popularity of improved kitcheners and so-called slow-combustion parlour grates, over the old-fashioned open ranges and "sham registers;" and the tendency is most conspicuous just where we should expect to find it—in those parts of the kingdom which lie away from the coal-fields. To a Southerner, there is nothing more striking in the whole of the North of England than the huge fires which the poorest cottagers are able to keep going. If house coal were generally used so thriftily in the North, and round about the coal-fields, as it even now is in some parts of the country, there would be a marked relief in the consumption. And if we take this line of thought a stage farther, is it so difficult to imagine the best modern open fire-grate carried across the narrow boundary-line that even now hardly separates it from a real closed stove? Yet this is an order of considerations that nobody who speaks in public on the subject of fuel economy seems to take account of. They all forget that while the step from a modern open fire-grate to a close stove is very short and easy, the step from the solid coal-fire to a really economical gas-fire is very long and difficult to make.

Professor Emerson Reynolds was sound upon the fuel-gas question, respecting which so much utter rubbish is vented upon a bewildered world. He sees that producer gas is not the acceptable solution of the problem, and that water gas is not much better. He understands, moreover, the conditions under which ordinary coal gas at 3s. per 1000 cubic feet may be a more economical fuel than coal. He cited the example of the kitchen of St. John's College, Cambridge, in illustration of these conditions; but he need not have gone so far from where he was speaking for even more striking proofs of the advantage of gas cooking in large establishments. The City of London

is full of examples of business houses where the gain by using gas for culinary purposes is hardly to be expressed in money. In houses where hundreds of inmates have to be fed daily, the change from coal to gas means more than economy in the fuel bill. It means less dirt, saving of room and rent, and many other savings; but not least does the gas-stove, when used in the large way, mean better meals and improved service. The lot of the shop assistant is often discussed, and ameliorations suggested; but, referring merely to the matter of cooking, it only needs a comparison between the style of living of the assistant in a large shop, as described in "Ten Thousand "a Year," and that enjoyed in houses of a similar class to-day, to recognize how much this indispensable order of workers owe to the gas-stove.

Professor Emerson Reynolds sees plainly enough how it is that the idea, so often put forward as a novelty, of a double distribution of fuel and lighting gas is impracticable; and, on the general question of gas supply, it is gratifying to find him, as a man of pure science, content to "take short views," like the poor gas manager has to do, and actually admitting that gas managers are on the right track in their current methods of making gas to suit the circumstances of the time. This is indeed a notable exception to the ordinary run of outside critics of gas manufacture, who commonly lament loudly over the perversity of the gas companies in going on making gas (and a little money) in their own unintelligent, practical way, instead of reaching out in all directions after the unattainable, as recommended by the critics aforesaid. There is much else in Professor Emerson Reynolds's address deserving the careful attention of gas engineers.

The European Gas Company.

THE European Gas Company have just held their annual general meeting, as will be seen by the report of the proceedings in another column; and the Chairman—Mr. H. M'Lauchlan Backler (who to his other excellent qualities adds that of being a regular reader of his JOURNAL)—took the opportunity for making some remarks upon the concession system under which the Company carry on their business. These observations are to be read as an authoritative, although necessarily brief, commentary upon our own recent observations with regard to the same subject. Mr. Backler commenced his remarks upon this topic with the admission that the Company of which he is the head cannot supply gas in France upon terms equal to those ruling in London; and he then went on to explain the reason for this disability, which lies in the concession system. In granting a concession to a Gas Company for a term of years, a Continental Municipality, said Mr. Backler, always seeks a *quid pro quo;* and seeing that the Municipality is always more in need of money than anything else, it displays immense ingenuity in exacting subsidies from the Gas Company which is permitted to do business within its borders. Of course, the burden falls at last upon the private consumers; but this does not trouble the Municipalities so much as it does the Gas Companies, who are subjected to invidious comparisons with others to which the same burden of indirect taxation does not apply. Upon the European Continent, as elsewhere, the only thing that strikes the eye of the gas consumer is the price he has to pay for his gas. What becomes of the money collected from him is a quite secondary consideration. He is usually not at all grateful for being compelled to bear most or all of the cost of street lighting, and to contribute to municipal coffers under various pretexts; and he is angry with the Company who take the money from him for these objects, just as a man is incensed in the first place against any inanimate object which happens to be the means of inconveniencing him personally. It is reassuring to the friends of the gas industry in general to note that, notwithstanding all rivalries and drawbacks, Mr. Backler is able to report a steady increase in the amount of business done by the European Gas Company. He is also able to declare that where the electric light is most in use, there the consumption of gas grows fastest. It is indicative of the universality, if the term may be so used, of the conditions affecting our industry in these days, that much of the tale Mr. Backler had to tell the shareholders of the European Gas Company would apply equally well to the proprietors of any British gas undertaking. Dear coal, recent strikes of miners and dockers, a falling market for residuals, an increasing trade done at a decreasing rate of gross profit—these circumstances occur all over the world, when they occur at all. In reading such confessions, whether they refer immediately to Havre, Hanover, or Huddersfield, it is impossible to avoid the conclusion that, after all, it is hopeless for the best and strongest individual gas director or manager to lift the undertaking for which he is directly responsible out of the stream of tendency that surrounds and envelops it. All that such an individual can do is to recognize betimes the conditions of his epoch, and trim his sails according to the prevalent wind. If he cannot hope to escape from the tribulations that he sees coming upon his neighbours, he can at least avoid mistaking their nature and strength, and can set his affairs in the best order for bearing the trial, when it comes to him in turn. The Chairman of the European Gas Company is a good example of this type of gas administrator. He does not attempt impossibilities, and he does not go out of his way either to meet difficulties or to shun them. He simply makes the best of circumstances as they come; and he is always discovered to have done pretty well, when everything is taken into consideration.

South-Eastern Coal.

MANY people must have asked themselves of late why it is there has been no apparent attempt to render the coal-seams which are reported to have been tapped at Dover available for increasing the fuel resources of the South of England. Many a time during the past winter, when the towns dependent for their light and heat upon coal shipped from the Tyne and Wear were face to face with darkness and cold, it must have occurred to Southern gas managers and householders to wonder why that puller of many wires, Sir Edward Watkin—for whose honour and glory the South-Eastern Railway and all its appurtenances, including the trial boring for coal at Shakespeare's Cliff, are understood to exist—has done nothing to put upon the market the coal declared to have been found at this spot. Something was said at the recent meeting of shareholders of the South-Eastern Railway Company which was presumably intended to throw light upon this mystery. But, in the event, it only went to show how completely an undertaking of this kind is in the hands of its Chairman, who can identify it by name with all sorts of speculative side schemes, or merely improve the property, according to whether the Chairman is a Sir Richard Moon, a Sir Daniel Gooch, or—well, a Sir Edward Watkin. It was stated that the promoters of the coal-mine scheme, of whom Sir E. Watkin is, of course, the head and chief, are awaiting a communication from the Department of Woods and Forests respecting the amount of royalty, if any, which the Crown will exact upon the coal to be raised; and when this point is satisfactorily settled, it is intended to spend £40,000 in putting down a shaft. Naturally, Sir E. Watkin thinks this is not a case for any royalty, and he seems inclined to go to law with the Crown upon the subject, in which event the date of the appearance of South-Eastern coal in the market will be indefinitely postponed. The mineral itself is reputed to be identical in character with the product of the Belgian field, which is not altogether bad for gas making, although the illuminating power is not high. There are ill-conditioned people who aver that the South-Eastern pit will never do anything beyond making a mess in a place hitherto known as a health and pleasure resort; but such talk is manifestly inspired by envy of the indefatigable South-Eastern Chairman, who seems bound to go on burrowing or building, if only to keep himself well before the public.

A Hard Case; but Good Law.

ENGINEERS and contractors should, and doubtless they will, take very particular notice of the judgments of the Courts in the case of *Bottems v. The Mayor and Corporation of York.* Indeed, as remarked in the course of a *Times* leader upon the case, the whole affair is deserving of attention by a wider circle than that of the professional and business men who are likely to be most immediately interested in it. The story is simple and ordinary enough. The Corporation of York wanted some sewers constructed; and the contract was put up to competition. One of the tenders was found to be very much less than all the others; and there is reason to believe that the Engineer, or somebody, was reluctant to see this tender accepted, on the ground that the job could not possibly be carried out for the money. It is always a

delicate thing to meddle with tenders, or even to pass over the lowest, especially where the expenditure of public money is concerned, and where no fault can be found with the standing of the lowest tenderer. However, in this case, the strong step was taken of warning the would-be contractor of the position in which he stood in comparison with his rivals, in order that, if he had made any mistake, it could be corrected, or that the tender might be withdrawn. The tenderer took no advantage of this opportunity, beyond walking once more over the ground where the work was to be executed; and he repeated his offer, which was accepted in due course. The terms of the agreement and specification were confessedly strict—reserving a very wide discretion to the Engineer, who presumably had good reasons for insisting upon retaining extensive powers over the carrying out of the contract. At any rate, these terms were regarded by all the Judges who perused them as onerous in the extreme; but it was allowed that the contractor accepted them with his eyes open, and that all the others would have willingly done the same at a price. Very soon after the commencement of the work, the contractor learnt what these conditions meant. He had not taken the most ordinary precautions to acquaint himself with the nature of the subsoil in which the sewers had to be laid, and some of the work had, at the very start, to be cut out and done over again without extra charge. The farther he went, the worse the prospect became. With ruin staring him in the face, the unhappy man urged the Engineer to abrogate the rights he had reserved under the specification; and upon his refusal, in the interest of his clients, to do so, the contractor threw up the job, and the Corporation seized his plant. It was clearly a hard case; and the Courts had to say whether the poor contractor should be held to his bargain, or whether he should be held to be justified in breaking his own engagements merely because they were turning out most disastrously for himself. The judgment of the first Court, confirmed on appeal, is stern, but just. The contractor, having taken a burden upon himself too heavy to be borne, is not on that account to be absolved from the consequences of breaking his bond. He should have looked before he leaped. Having failed to do so, he could not expect the Corporation of York to treat him differently from any other contractor who might have occupied his place with more circumspection. We notice that *The Times* pleads for the man with the Corporation; and far be it from us to say anything to prevent the showing of mercy when it is appealed for. We have no sympathy whatever with public bodies who get their work done too cheaply at the cost of contractors. Good work is worth its price everywhere; and it is not a pleasant sight to watch a wealthy Corporation driving into the Bankruptcy Court a poor tradesman whose only offence has been an overweening confidence in his own business ability and resources. All the same, it is but fair to say something on behalf of the Engineer of this York Corporation job, upon whom some of the reflections called up by the case of Mr. Bottems inferentially cast some censure. He had more prudence than the successful tenderer. He suspected that the execution of the work might not be all plain sailing; and so he protected his own design, and the interest of his clients, by reserving to himself such wide powers over the sanctioning of payment for extras, and other matters, as should have been caution enough to any careful man of business to appraise his risk accordingly. There was no compulsion upon anybody to take up this much-abused contract; but Mr. Bottems would have it, at his own price, which was insufficient. So long, therefore, as Corporation work is to be done by contract, and the Engineer is to be held responsible for the efficiency of his plans, and not for the financial result to the contractor of carrying them out, it seems to us that such cases as that of Mr. Bottems will be certain to recur.

The Gaslight and Coke Company's Dividend.—The Directors of The Gaslight and Coke Company recommend a dividend for the half year ending June 30 last at the rate of 12 per cent. per annum; carrying forward £21,783.

The Secretaryship of the Enfield Gas Company.—Mr. C. W. Offord has been appointed Secretary of the Enfield Gas Company, in succession to the late Mr. John Purdey, who filled the office from the formation of the Company in 1850 till his death early in the present month.

WATER AND SANITARY AFFAIRS.

THE discussion in *The Times*, as to the pecuniary result accruing to the ratepayers from the rejection of Lord Cross's scheme for the purchase of the Metropolitan water undertakings, has been followed up by a brief letter from Sir Thomas Farrer accepting Mr. Burdett's statement that he is solely responsible for the calculations contained in his book respecting the Companies and the purchase scheme. Sir Thomas withdraws all imputations as to unfairness, or want of care, on the part of Mr. Burdett; but he considers that the calculations in the book do not settle either of the questions involved in the dispute. One of those questions is whether the London ratepayers would have made a profit out of Lord Cross's bargain. This, we apprehend, is the only practical question to be debated; and certainly it is the most important. It is also a question which Mr. Burdett's book fairly settles, though not to the satisfaction of Sir T. Farrer. A letter from Colonel Makins, published yesterday, calls attention to the manner in which Sir T. Farrer evidently implies that the Water Companies ought not to be allowed anything for goodwill, or for compulsory purchase. This Colonel Makins condemns as a "raptorial policy," not redounding to the credit of the great municipal authority which Sir Thomas "otherwise adorns." A contribution to *The Times* last week consists in a very long article on "The Water "Supply of London." It is described as "From a Corre- "spondent;" and its general tenor is in favour of superseding the river supply by going to a more distant source. As the article in question is to be followed by another (and perhaps by more than one), it may be as well to postpone further comment until we know more fully what the writer has to say. One other matter affecting the water supply is of a somewhat recondite character. The London County Council have just agreed to make a second contribution of £250 to the Royal Society, to defray the cost of a scientific investigation into the vitality of microscopic pathogenic organisms in water. Concurrently with this vote, the Government have agreed to make a second grant of like amount. Thus a thousand pounds will be expended in the research; half of it coming out of the pockets of the Metropolitan ratepayers. What the latter will make by this particular bargain is uncertain.

There were three sittings of the Metropolitan Water Supply Commission last week. The progress made was not very marked, though the evidence was of value on points of detail. Some corrections were offered in respect to statistics; Mr. Restler explaining that in the case of the Southwark and Vauxhall Water Company (of which he is the Engineer), the returns sent in to the Water Examiner show the quantity of water which ought to be raised by the engines and pumps; but 10 per cent. might be deducted for slips and short strokes. In the case of the Kent Company, it did not appear that any correction was required; and, according to a test applied, the population seemed to have been very correctly estimated. Concerning the Thames, the Chairman of the Sanitary Committee of the Surrey County Council gave evidence as to the pollution of the tributaries, especially the Wey; the statements of the witness showing incidentally that the Local Authorities which might take action to purify the streams were generally content to leave the task in the hands of the Thames Conservators, who received £18,000 per annum from the Water Companies. Yet the witness contended that, in respect to the sewage of Godalming and Guildford, the enforcement of the Rivers Pollution Prevention Act was due rather to the County Council and other Local Authorities than to the Conservators. The Commissioners were also assured that the Surrey County Council felt it to be in their interest to carry out the provisions of the Act, and to keep the Thames as pure as possible. There was no risk, said the witness, "of realizing the fearful picture "which was drawn, of what might be the condition of "the Thames in the event of the Water Companies' con- "tributions ceasing to be paid to the Conservancy." With respect to this kind of evidence, we would observe that, whatever may be the state of affairs on the tributaries, or on certain parts of the Thames, there are analyses which show the character of the supply, and which prove it to be wholesome. A representative witness from Essex endeavoured to raise the question as to the future Water Authority; but Lord Balfour promptly

intimated that this was a subject with which the Commission had nothing to do—a point on which we addressed our readers some time ago. This witness was particularly anxious that the Essex district bordering on London should not be drained of any more water for the supply of the Metropolis. The rapid increase of the population in these outlying parts showed (so it was urged) that no more water could be spared. A witness from another quarter expressed a fear that the River Colne was about to be run dry. Lord Curzon, M.P., said the people of South Buckinghamshire were apprehensive of suffering considerable damage if any large scheme was carried out for drawing upon the water supply connected with the Colne and the Thames. Lord Balfour, in questioning the witness, seemed to be of opinion that South Buckinghamshire would be better able to discuss the matter when some definite scheme was propounded. This, we apprehend, is a consideration which would apply very fairly to the objections raised by authorities all round London, as to allowing any more water to be drawn from their districts. The assumption that they have no more water to spare is as yet without proof; neither is it clear how these districts would be affected by any enlarged scheme. Evidence was also given before the Commission as to the effect of the Harefield wells in the Colne Valley. On another point in the inquiry—namely, the state of the River Lea as affected by the drainage of towns in the upper part of the valley—some precise and valuable evidence was given by Major Lamorock Flower.

The Appeal in the Gadd Case.—The appeal in the case of *Gadd v. Mayor and Corporation of Manchester* was in the list last Friday for early hearing by Lords Justices Lindley, Lopes, and A. L. Smith, in Appeal Court II.; and it may therefore be expected to come before their Lordships in the course of the present or next week.

Reduction in the Price of the Electric Light in London.—Following the lead of the Westminster Electric Supply Corporation, noticed in the JOURNAL for the 5th inst., the London Electric Supply Corporation announce that the charge for current supplied by them will be reduced to 7d. per Board of Trade unit, as from the commencement of this quarter.

North of Ireland Association of Gas Managers.—Many of our readers will learn with regret that, owing to a family bereavement, Mr. D. M'Callum, of Omagh, will be unable to preside at the forthcoming annual meeting of the above Association. This duty will therefore devolve upon the Vice-President (Mr. W. S. Stormonth, of Coleraine). Mr. M'Callum has lately lost his son, who was Financial Secretary of the National Board of Education.

An Adventurer's Share in the New River Company for Sale.—At the Mart, Tokenhouse Yard, E.C., to-morrow afternoon, Messrs. Edwin Fox and Bousfield will offer for sale, in one lot, an entire Adventurer's share in the New River Company. It produces an income of £2602 per annum, and carries with it the reversion, in twenty years, to town properties of great value. The purchaser will become entitled to a seat at the Board. In addition to the large revenue derived from water-rents and water sold in bulk, the Company have a considerable rental from properties in the counties of Middlesex and Hertford, as well as in the City of London.

A New Scale of Patent Fees.—On the 1st of October next a new scale of fees for patents, by which a considerable reduction will be effected, will come into operation. The revised scale is given as a schedule to a fresh set of rules; and the whole will be found on pp. 661-2 of the current number of the *Illustrated Official Journal* (*Patents*). The fee payable on the application for a provisional specification remains £1; and on filing it, one of £3 has to be paid. On the certificate of renewal before the expiration of the fourth year from the date of the patent, and in respect of the fifth year, the fee is £5; with an additional £1 for each year up to the fourteenth. The time for the payment of renewal fees will be extended for not exceeding a month for a fee of £1; two months, £3; and three months, £5.

Association of Municipal and County Engineers.—The nineteenth annual meeting of this Association was opened at Bury on Thursday last, under the presidency of Mr. J. Cartwright, Borough Surveyor of that town. The annual report presented by the Secretary (Mr. T. Cole, Assoc.M.Inst.C.E.) showed that in the financial year ending in April last 106 new members had been elected, including 94 ordinary members and 12 graduates. The number at the close of the year, including 10 honorary members, 454 ordinary members, and 39 graduates, was 503, or 100 more than in the preceding year. The report having been adopted, the President delivered his Inaugural Address; and subsequently a paper on "Street Tramways and Electric Traction" was read by Mr. J. H. Cox, Borough Engineer of Bradford. At the close of the business of the day, the members visited a number of works in the town. The sittings were resumed on Friday.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 174.)

THERE is no particular change to note in the general position of the Stock Exchange; but certainly, on the whole, the feeling was much less depressed than it had been the week before. There was, however, no increase of activity. Things remained very quiet; and seeing that we are entering upon the autumn vacation, there is little probability of their getting any brisker unless something unforeseen should crop up and give them a fillip. The Money Market continues in the same languid state, and without any prospective chance of a change. The Gas Market, however, has been much more interesting. The chief event was the announcement of The Gaslight and Coke Company's dividend. It had been expected in well-informed quarters that, with the aid of the increased price, the Company would come out about right—notwithstanding the Durham coal upset; and the announcement now shows that they have earned their full statutory dividend of 12 per cent., carrying forward a balance of £21,783. This has had a very favourable effect on the market. The "A" stock, which opened on Monday at 211, steadily improved day by day, until the closing bargain marked on Saturday figured at 223; and the quotation showed a rise of 9 for the week. The continuing demand for good investment stocks keeps the secured issues well up, although quotations have not advanced. South Metropolitans have been fairly well supported; and the "A" stock has risen 1 more. Commercials are being bought; and some parcels of old stock changed hands at good figures, while the price of the debentures has been put up 2 higher. The Suburban and Provincial undertakings attracted but little notice, though Brighton advanced 1. The Continental companies have more than maintained their strong position of the preceding week, and have risen in value. Of the rest, the only one to present any feature is Oriental, which has advanced in price. Very little business was done in Water stocks; but the quotations of several have been put down rather freely, and they are not unlikely to go lower.

The daily operations were: The Gas Market was rather quiet, though firm, on Monday, business being almost wholly in the Metropolitan undertakings. Brighton and Hove rose 1. Tuesday was more animated, and prices rose. Gaslight "A" advanced 1½; Commercial debenture, 2; and Imperial Continental, 1. In Water, Chelsea fell 3; and Lambeth, 2. Wednesday's dealings were largely in Gaslight "A," which rose 2 more. The rising tide continued to flow on Thursday; all stocks commanding good figures. Gaslight "A" rose 1½; and South Metropolitan "A," 1. Lambeth Water fell 1. Business was much quieter on Friday; but values still improved. Gaslight "A" advanced 2; European, ½; and Oriental, ¼. The same tendency characterized Saturday—Gaslight "A" gaining 2; and Imperial Continental, 1½. In Water, Kent fell 2; and Lambeth, 1. But West Middlesex was 1 better.

ELECTRIC LIGHTING MEMORANDA.

The Regulation of Overhead Wiring—An Aspect of the Electric Lighting Industry—An English Report upon Incandescent Lamps—The Quality of American Incandescent Lamps.

LOCAL self-government is a thing which, in theory, every citizen duly imbued with modern ideas unreservedly admires. Human nature is stronger than any theory, however; and so it generally comes to pass that, when a particular development of the local self-government idea touches upon a man's business or personal interests, he straightway becomes a strong advocate of centralization for regulating purposes. Thus, there could hardly be a more modern local authority than the London County Council; and everybody knows that, so far from possessing too much power, it is the constant cry of members and admirers of the County Council that this highly-progressive body is crippled by the refusal of a jealous Government to give it a "free hand." Again, if practitioners of the most modern art and industry of electrical supply are not men of very enlightened ideas on all subjects, where are such to be looked for? Yet the moment these two advanced organizations—the County Council and the electrical supply industry—meet in conflict with regard to such a simple, but touching matter of common concern as rules for overhead wiring, the latter protests that its interests will not be safe until all such matters shall be "efficiently carried out by a competent and well-equipped Electrical Department of the Board of Trade." We have all felt like this in regard to various matters. A system of regulation that really regulates is never thought well of by those to whom it is applied. Electricians, in appealing from the County Council to the Board of Trade, may very easily discover that the progress is only one "from the frying-pan into the fire."

Speaking on the subject of overhead wiring, it may be remarked that, in consequence of the rigidity of the control now exercised over the wires used for conveying electric lighting currents, there is much less isolated electric lighting in London than was to be seen two or three years ago. Up to that period, there were many shops all over the Metropolis supplied by small speculators in this line, who had little establishments in convenient backyards and factory basements, whence they ran

overhead distributing wires to wherever they could find customers—sometimes at a very considerable distance. It will be remembered that the London Electric Supply Corporation originated in this way. And the remarkable point of this "story of origins" is that these small lighting businesses did pay after a fashion; the capital and management expenses being kept strictly limited to the extent of the business done. When people talk about the popularity or the profitableness of electric lighting in the United States, it should be borne in mind that the business referred to is of an analogous kind to that done by the rough-and-ready installations now in question, which, as already stated, were to be found in London, Glasgow, and other large towns of the United Kingdom some years back. Trouble came, however, when the possible danger attending the operation of these cheap generating stations attracted the notice of local authorities, and when the proprietors of the ventures set about giving a more permanent character to their undertakings. Overhead wiring regulations simply killed the majority of the temporary electric lighting speculations; and of those that succeeded in emerging into the more perfect form of a duly licensed undertaking—with directors, mortgage debt, and other luxuries of advanced culture—there is hardly one that pays its way. It is the hope of the new statutory electric light companies that, as they extend their mains through the streets, they will pick up the scattered customers who, through the demise of the old overhead speculators, have been compelled to return to gas. There is a certain amount of justification for this hope; but in many cases shopkeepers and others who have had experience of both systems of lighting, declare that they do not mean to make another change.

In the number of the *Electrician* for the 15th inst. appears a report of a kind which is extremely rare. This is a statement drawn up by three students of the Central Institution of the City and Guilds of London, under the guidance of Professor Ayrton, upon the performance of six Edison-Swan incandescent lamps, as tested in the laboratory of the Institution. As our contemporary remarks, users of this kind of lamp in the United Kingdom are wholly dependent upon the manufacturers in respect of the quality of these goods. They mark and send out their lamps, and their customers must take the nominal 8 or 16 candle article, or whatever may be its stated candle power, quite upon trust. Of course, it is not pretended that the Edison-Swan Company have abused their position, as is done, for instance, in the matter of the French governmental match monopoly. They do sell good lamps; and if they charge a high price for their wares, who would not do likewise in their place? The point upon which patrons and observers of incandescent electric lighting are most curious, and upon which it is apparently impossible to obtain trustworthy information, is the precise relationship of the duty given by a particular make of incandescent lamp to its durability in action. The report under notice has more to say about the duty of lamps in various positions and in different circumstances than about their durability at various pressures. It is interesting to note that Professor Ayrton favours the use, in his pupils' photometrical work, of the Methven slot and the Joly split paraffin screen. To very briefly summarize the results of this investigation, it may be stated that the watts per candle at the normal voltage of the lamps tested varied from 3·8 to 4. The best photometrical results were obtained when the plane of the filament loop was parallel with the screen, and at an angle of 45° with it. There was a notable falling off when the lamp was presented "end on" to the screen, when the light was diminished by from 25 to 50 per cent. Thus, there is good reason for the angular position given to incandescent lamps in most electroliers; and it must be conceded that, when lamps are simply hung point downwards from cord suspenders, they do not efficiently light the spot immediately beneath them.

Another report upon incandescent lamp performance, very much less complimentary to its subjects than the conclusions of Professor Ayrton's pupils, has been given by Professor Thomas and Messrs. Martin and Hasler, in the form of a paper read before the American Institute of Electrical Engineers. These investigators took 127 lamps as sold by the different makers supplying the American market, and ascertained their mean horizontal candle power before and after a run of 1000 hours. They find the best initial efficiency to be 3·8 watts per candle, and the worst 5·4 watts per candle; while the efficiency after 1000 hours' burning varied from 6·1 to 7·9 watts per candle. Only five lots out of the thirteen gave the full rated 16 candles illuminating power at any time; and if the average of all is taken, as suggested by the authors, it shows that in America the lamp commercially rated at 16 candles may be expected to give about 15 candles at the start for an expenditure of 63·6 watts, falling to about 8½ candles after 1000 hours' use, with an expenditure of 58 watts—or an average illuminating power of 11 candles for an average expenditure of 61·6 watts. The result of this inquiry is not flattering to the American cheap lamp. The Edison-Swan Company would resent as a libel upon their system of doing business, any suggestion that these figures may be held to apply to the British trade in incandescent lamps; but the record will stand as a warning of what users of such goods must expect when the present monopoly of incandescent lamp manufacture and sale in the United Kingdom yields, as it will soon, to unrestricted competition among makers from all parts of the world.

NOTES.

An Example of Warming and Ventilation.

An elaborate report upon the arrangements for heating and ventilating the William J. Syms operating theatre of the Roosevelt Hospital, New York, constituted the graduating thesis presented by Messrs. H. D. Whitcomb, jun., and H. C. Meyer, jun., of the Stevens Institute of Technology. The full text of the report, with illustrations, appeared in a recent number of the *Engineering Record*. The effectual ventilation of hospital buildings involves the displacement of a much greater bulk of air in proportion to the dimensions of the enclosed spaces than is required for residential edifices. As to the number of cubic feet of air required per hour for hospital ventilation, authorities differ. General Morin, whose figures are often quoted in connection with this subject, estimates the requirement at 3530 cubic feet per head per hour in hospitals for wounded, and 5300 cubic feet per head per hour for epidemic diseases. In the example under notice, for which Mr. W. J. Baldwin was the mechanical engineer, the indirect system is used. The cold air is taken in by a shaft 5 ft. by 5 ft. 4 in., running from the roof to the basement, and then passing over a single coil of heating pipes into the fan chamber. These primary coils are only used in extremely cold weather. The supply for the theatre is drawn into the heating chamber by a 66-inch Sturtevant fan. The heating chamber has six coils of pipes, all separately connected, so that the attendant can turn on as many as the temperature of the air requires. These coils are enclosed in galvanized iron boxes, so as to ensure the air passing in close contact with the warm surfaces. The air thus warmed is delivered into the theatre under the seats; the outlets of the ducts being curved over into goose-neck form, so as to direct the air upon the floor, and not against the legs of the sitters. The foul air is removed by an aspirating chimney 6 feet by 3 feet inside, taking off immediately underneath the ceiling, and discharging well above the roof. A coil of pipes is placed in the shaft to stimulate the ascent of the air in cold weather. These are heated by the exhaust steam from the fan engine. The plant was designed to pass a million cubic feet of air per hour, and is described as completely successful.

A Naphtha Process of Garbage Destruction.

A novel system of garbage destruction is reported as being in operation at Providence, Rhode Island, which is considered as a success by the Superintendent of Health for the city. The scavenging is done by contract at a charge of 15½ c. per head of the population. All the perishable rubbish is sent to a chemical works, where it is treated under certain patented processes owned by Mr. Simonin, who now leases the factory, and claims to make money out of it—taking the raw material as delivered gratis. Substantially, the process is as follows: After having been unloaded, the garbage is allowed to drain, in order to get rid of some of the superfluous water. It it then loaded upon a pile of shallow trays carried by trucks into the evaporators, which are large iron shells measuring 6 feet by 18 feet, where the stuff is left for 24 hours to be acted upon by hot naphtha and naphtha vapours under a pressure of about 35 lbs. per square inch. The effect of this is to dissolve out the grease, which falls to the bottom of the chambers, whence it is drawn off, and the naphtha afterwards separated for use again. Live steam is then turned into the chambers until every trace of naphtha disappears, when the doors are opened, and the residuum (which is said to be perfectly odourless) is removed. A similar process is employed by the Cincinnati Desiccating Company for the treatment of various commercial residuals. As worked at Providence, the system is accused of creating a nuisance; but this is explained by the rough-and-ready method of working, and the cheap style of the plant employed. If properly managed, it is asserted that the process need not prove objectionable.

The Liquefaction of Oxygen and Air.

Professor Dewar recently lectured at the Royal Institution upon the liquefaction of oxygen and atmospheric air, which was effected before the audience, without pressure, by application of the cold produced by the evaporation of liquid nitrous oxide and liquid ethylene. The lecturer first filled a test-tube with liquid oxygen, which appeared cloudy from the presence of some unknown impurity. After having been filtered, like water, it was quite clear. Its image projected on the screen had a cold pale-blue colour, and it boiled violently at the temperature of the air, with a hissing noise—giving off clouds which looked like white smoke, but which were really due to freezing of the moisture in the adjacent atmosphere. By means of the evaporation of some liquid oxygen, Professor Dewar liquefied some air in an open test-tube at the ordinary atmospheric pressure. The fluid appeared clearer than the liquid oxygen, and boiled more quietly. The magnetic property of liquid oxygen was also demonstrated. Curiously enough, when common air is liquefied, the oxygen and nitrogen do not separate, but both come down together. In evaporating, however, the nitrogen boils off before the oxygen. A somewhat sensational incident of the lecture was the pouring out of a wineglassful of liquid air, which was handed to the Chairman (Lord Kelvin), who was cautioned to hold the glass only by the stem. Liquid oxygen and air will remain permanent in open vessels at ordinary atmospheric pressure for some time, simply because their cooling action is so

violent that they quickly reduce the temperature of the receptacle and the surrounding air below what is required to maintain them in rapid evaporation.

The Berthelot-Mahler Calorimeter.

Mr B. H. Thwaite has undertaken the introduction into British technological circles of the Berthelot-Mahler calorimeter, which he exhibited at the recent meetings of The Gas Institute and the Iron and Steel institute. In its latest industrial form, this instrument consists of a shell made of superior mild steel, nickel-plated externally, and enamelled within, to preserve the metal from the effects of the products of combustion. It has the form of a conical projectile (whence its French name of the "calorimetric bomb"); and the internal combustion chamber has a capacity of 654 cubic centimetres. The walls are 8 mm. thick. The vessel has a ferro-nickel lid, and a superior valve which permits of the introduction of the oxygen for the combustion of the charge. The top is also traversed by a well-insulated electrode, terminating inside in a platinum conductor. There is also a suspended saucer for containing the sample of fuel to be tested, into which the conductor dips; contact being made more perfect by the interposition of a fuse of iron wire of known weight. The process for making a test consists essentially in putting in a weighed charge of fuel, then admitting oxygen to a pressure of 25 atmospheres, and igniting the fuel by the electric current while the shell stands in a water-bath, the temperature of which is observed at short intervals. The necessary data for working the apparatus correctly have been determined by M. Mahler. Some little difference of manipulation is necessary, of course, when the fuel to be tested is gas. The Berthelot-Mahler calorimeter is made by M. Golaz, of the Rue St. Jacques, Paris.

Illness of Dr. Werner Siemens.—We regret to learn that Dr. Werner Siemens, brother of the late Sir W. Siemens, who occupies an eminent position as a scientist and electrical engineer, is lying seriously ill of fever. He is in his 76th year.

Accident to Mr. J. F. Robinson, of Liverpool.—We regret to learn that Mr. J. F. Robinson (the Treasurer of the Liverpool United Gas Company), who is Colonel of the 1st Lancashire Engineer Volunteers, met with a shocking accident on Saturday week, during an inspection of his regiment at Sefton Park, Liverpool. His horse bolted; and in attempting to leap a wire fence, was caught in its hind legs and fell, the rider being under it. Colonel Robinson was severely injured, and for some time was unconscious. The ambulance carried him to his residence; and the inspection abruptly closed.

The Royal Society's Investigation into the Quality of Water.—At the meeting of the London County Council last Tuesday, it was agreed that, subject to an estimate being submitted to the Finance Committee, as required by the statute, the Council should contribute a further and a final sum of £250 towards the expenses of the investigations now being carried on by the Royal Society into the question of the vitality of microscopic pathogenic organisms in water. The Royal Society have stated their expectation that the results of these investigations, on which Dr. Percy Frankland and Professor Marshall Ward are engaged, will have a very high scientific value, and will, moreover, be of great practical utility. An additional grant to a like amount has been made by the Government.

The Engineership of the Wolverhampton Corporation Water-Works.—A special meeting of the Wolverhampton Town Council was held last Wednesday, for the purpose of appointing a Water Engineer to undertake part of the work at present performed by Mr. Lyons Wright, who is relinquishing those duties in consequence of ill-health. The salary offered was £250 per annum. Alderman Marston, Chairman of the Water Committee, said that 138 applications for the office had been received. These had been sifted by the Committee, who recommended for the final selection of the Council the following three gentlemen: Mr. T. Raynes, senior assistant to the Engineer of the Birmingham Water-Works; Mr. W. Jones, of the Liverpool Corporation Water-Works; and Mr. E. A. B. Woodward, of St. Helens. A vote was taken, and 17 members voted for Mr. Woodward and a similar number for Mr. Raynes. The Mayor (Alderman Saunders) gave his casting vote in favour of the former, who was then elected.

Transactions of the Society of Engineers.—We have received from the Secretary of this Society (Mr. G. A. Pryce Cuxson) the volume of Transactions for the past year, which has been produced under his editorship. The contents of the book are of more than usual interest to our readers, inasmuch as they include the paper read by Mr. C. C. Carpenter on "Modern Coal Gas Manufacture," and the one on "Machine Stokers for Gas-Retorts" submitted to the Society in October by Mr. H. O'Connor. Both of these contributions to the Society's proceedings last year were noticed in the JOURNAL at the time they were brought forward. The text is illustrated with plates, which add to the utility of the papers to an engineer who is not specially engaged in the construction or management of gas-works. A short account is given of the vacation visits; and the work of the members who were removed by death last year is duly recorded. The volume contains a useful index to the Transactions from 1861 to 1891. The book is published by Messrs. E. and F. N. Spon.

COMMUNICATED ARTICLE.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

PURIFICATION.

(*Continued from Vol.* LIX., *p.* 1117.)

On leaving the condenser, the gas is conducted to the washer and scrubbers. It is usually at this stage—before entering the washer—that the gas is passed through that most useful and, in large works, indispensable apparatus, the exhauster. Here it is "exhausted," as it were, from the retorts, and propelled through the various purifying appliances which confront it on its course to the gasholders; and that accumulation of back-pressure in the retorts which, in its absence, must necessarily ensue (to the detriment of the gas and the retorts, and also of the carbonizing returns), is obviated. In order, however, to preserve the continuity of the important subject of purification now under consideration, the writer proposes to postpone for the present further reference to this apparatus, so that the study of the course taken by the gas through those progressive stages which culminate in the final separation of its various deleterious impurities may be uninterruptedly pursued.

We have already disposed of much tar, some ammoniacal liquor, and a proportion of other substances. Under the ordinary working conditions at the majority of gas-works—that is, where certain forms of condensers which embody washing apparatus in their construction are not employed—there will remain some tar (chiefly in the minute globular form already referred to), the bulk of ammonia, and other impurities. To remove the last trace of tar, and, in doing so, a large proportion of the ammonia also, is the special function of the washer. The scrubber is designed more especially for dealing with ammonia, carbonic anhydride (CO^2), and sulphuretted hydrogen, after the crude gas has been entirely freed of the presence of the tar.

Many very good forms of apparatus combine, to a certain degree, the functions both of the washer and the scrubber. As to the various contrivances designed for dealing with this phase of gas purification which are now in the market, their name is truly "Legion;" and the briefest description of the whole of them would fill many columns of the JOURNAL. It will therefore be better simply to describe the principles underlying successful gas washing; and the description of one or two typical forms of apparatus will then doubtless suffice.

For the full understanding of the subject, it is necessary that we should know something of the characteristic properties of the substances with which we have to deal, as just enumerated. We shall then better see how they may be laid hold of, and, if possible, be put to good use; being caused themselves to aid in the work of purification.

The condition in which the remaining tar is present in the gas we know already. The only means remaining for depositing those tarry vesicles which have so far successfully evaded the ordinary processes of condensation is friction. This may be secured by passing the gas through finely perforated plates, or through a series of serrated dip-plates, &c., and dashing the wire-drawn streams thus produced against baffle-plates, or in other ways dividing and subdividing the streams of gas as much as possible. In this way the little globules are broken; and the whole of the tar, being completely separated, falls to the bottom of the apparatus, and passes away by its proper outlet.

Ammonia, carbonic acid, and sulphuretted hydrogen are present in the gaseous form. Some ammonia exists, in combination with acids, as salts. These, being readily soluble in water, are largely separated during the process of condensation.

Ammonia is very soluble in water, which, under ordinary temperature and atmospheric conditions, will absorb nearly 800 times, and at freezing-point 1100 times, its own volume of the gas; forming the well-known liquor ammoniæ of commerce (ammonium hydrate, NH_4 HO). It is highly alkaline—turning reddened litmus blue, and turmeric paper brown, and having a great affinity for acids, with which it readily forms salts, which are also soluble in water. Both the hydrate and the salts are more or less volatile, and readily give off ammonia on the application of heat. The solubility in water of the gas and its alkaline properties are both made use of in the processes at work for extracting it from coal gas. The volatile properties of the hydrate and the salts necessitate the thorough cooling of the crude gas before this stage of purification is entered upon, as already explained.

Carbonic acid gas, or carbon dioxide (CO_2), is also soluble in water; but in a much more limited degree. One volume of water, at ordinary temperature and pressure, dissolves the same volume of the gas; but the latter will be evolved again on the application of heat. As is well known, the solubility of the gas may be much increased by pressure, as when it is employed for imparting effervescence to certain bottled beverages. It has an acid reaction, faintly reddens litmus, and is readily absorbed by alkaline solutions, forming carbonates. Theoretically, the hydrated solution of carbon dioxide is carbonic acid ($H_2 CO_3$); but this acid has never been obtained in the pure condition, as on the evaporation of the dilute solution carbonic acid is expelled. The dry gas has no reaction, and is incapable of

supporting combustion; and if present in the purified gas, it would act as a diluent, and reduce the illuminating power. In the surrounding atmosphere, it would be hurtful to animal life; acting as a narcotic poison.

Sulphuretted Hydrogen.—This evil-smelling compound has many characteristic properties, not the least of which is its pungent odour. It is soluble in water, which dissolves three times its own volume of the gas; but the solution is unstable, and the gas is readily expelled on heating. It has an acid reaction, which it also imparts to the solution. It forms sulphides in the presence of hydrates, oxides, or chlorides of the metals, and is readily absorbed by caustic potash, soda, and ammonia, with the formation of sulphydrates, thus—

$$H_2S + NH_4HO = H_2O + NH_4HS.$$

If these solutions be mixed with an equal quantity of the alkaline solution, the neutral sulphides are formed, thus—

$$NH_4HS + NH_4HO = (NH_4)_2S + H_2O.$$

It present in the purified gas, sulphuretted hydrogen would, on burning, produce sulphurous anhydride (SO_2), and water in which the former is probably wholly or in part dissolved; sulphurous acid (H_2SO_3) being produced. Sulphuretted hydrogen is poisonous, as is also sulphurous anhydride.

Cyanogen Compounds.—On referring to the table of the constituents of crude coal gas given in the JOURNAL for June 7 (p. 1057), the student will observe that ammonia is also present in combination with cyanogen. Both these compounds are supposed to originate in the retort. The greater part of the nitrogen contained in the coal combines with the hydrogen present to form ammonia (NH_3), and a portion unites with carbon to form cyanogen (CN). This latter compound is present in the gas chiefly in combination with ammonia, as sulphocyanide; and in this form we find it in considerable quantity in the ammoniacal liquor. As already shown in the table just referred to, there are present in the crude gas many impurities other than those thus fully described. Most, if not all, of these are more or less separated by the washers and scrubbers; but they are more particularly dealt with in the calcium or oxide of iron purifiers.

A careful perusal of the various characteristic properties of ammonia, sulphuretted hydrogen, and carbonic anhydride, as just enumerated, will at once suggest to the reader that they are of such a nature as to render them capable of being put to good account by being caused themselves to facilitate the removal from the gas of these impurities, and probably of others also. This is what, in practice, is attempted; for by washing and scrubbing the gas with ammoniacal liquor, which itself contains these impurities, it is partially accomplished. In proportion as this principle can be successfully applied, thus reducing or obviating the necessity for purification by extraneous matters, such as the oxide of iron or calcium hydrate, so the importance of the methods employed will be enhanced, and the more perfect, theoretically and practically, must they be considered.

Given, then, the complete extraction of tarry matters, the chemistry of washing and scrubbing may be thus summarized: Coming from the condensers, the gas contains the various impurities stated. In the washer, and usually in one scrubber, it is brought into intimate contact with ammoniacal liquor. Part of the ammonia contained in this liquor is fixed (*i.e.*, in combination with other matters, as salts in solution); but a large percentage is free, and is simply held in the liquor. The latter not being saturated with ammonia, much of the impurity present in the gas will, of course, be at once absorbed, owing to its remarkable affinity for water.

The acid reactions of carbonic acid gas and sulphuretted hydrogen result in the gradual absorption also of these impurities by the free ammonia present in the gas or in the liquor. Carbonate ($[NH_4]_2CO_3$) and sulphide ($[NH_4]_2S$) of ammonia are thereby formed; these salts being retained in the liquor.

Another important impurity which is more or less reduced in quantity by the indirect action of ammonia is bisulphide of carbon (CS_2). This compound is usually extracted chiefly by sulphide of calcium (CaS) in the lime purifiers; but it may readily be arrested by the sulphides of the alkalies. Hence the sulphide of ammonium, the existence of which in the liquor has already been accounted for, provides a ready means for assisting in the extraction of this impurity; a sulpho-carbonate of ammonium being formed, thus—

$$(NH_4)_2S + CS_2 = (NH_4)_2S,CS_2.$$

It will now be seen what an important factor in the purification of coal gas the presence of ammonia has proved to be; and so long as there is free ammonia present, either in the gas or in the liquor, so long may it be put to good account in effecting the removal of the impurities named. The student will therefore see that the presence of free ammonia in the liquor of commerce is indicative of the waste of so much of a valuable purifying agent.

Further, "when strong ammoniacal liquor is passed through a scrubber, and exposed to the action of the gas, it parts with more or less sulphuretted hydrogen, which is displaced by carbonic acid." (Professor Wanklyn's "Gas Engineer's Chemical Manual.") The continued use of strong liquor after complete saturation would therefore be not only useless, but actually prejudicial. It will thus be seen that the extent to which the process of purification by scrubbing with gas-works liquor alone may be carried will largely depend upon the relative proportions of ammonia gas and carbonic acid present. So long as there is sufficient of the former to neutralize both the carbonic acid and the sulphuretted hydrogen, all will be well; but when the supply of free ammonia fails, the carbonate will be formed, to the decomposition of the sulphide and the expulsion of sulphuretted hydrogen. The last traces of ammonia, and probably small quantities of carbonic acid and sulphuretted hydrogen, should be removed by a separate scrubber, provided with a thorough wash (though in small quantities) of clean water.

This latter remark, as regards the first of the impurities named, while fully endorsed by many authorities, is questioned by others. Moreover, when every trace of free ammonia has been removed in the scrubbers, this impurity has at times nevertheless shown itself in the purified gas (*i.e.*, on the outlet of the purifiers). This may be due to the decomposition, in the purifiers, of cyanides, and a resultant production of free ammonia. It shows, however, that the absence of the free gas on the outlet of the scrubber is not a sufficient guarantee of a like absence on the outlet of the purifiers. It has further been urged that the presence of traces of ammonia in the purifier assists in the work there similarly to its action in the scrubbers. This is undoubtedly the case, or, at all events, where lime is used. There are, however, certain troubles attending its presence in the purifier—chiefly the nuisance caused when the latter is opened—that seem to indicate that the old-fashioned idea is the best. In the summer time, owing to the high atmospheric temperature, it is a difficult matter to eliminate all traces of the impurity in the scrubber; but excessive scrubbing must be guarded against, or the illuminating power of the gas will be prejudicially affected.

Many attempts, attended with a varying measure of success, have been made to practically apply the mutual affinities of these impurities one for the other, in effecting their *complete* removal from the gas; but great difficulties have so far been experienced—chiefly, probably, owing to the highly volatile nature of ammonia salts or hydrate, and the consequent difficulty in revivifying the liquor. The Claus method of purification is based on this principle. By this system, the ammoniacal liquor to be "revivified" or "desulphurized" is exposed to the action of carbonic acid, whereby the sulphide present is decomposed; sulphuretted hydrogen being set free, and the carbonate alone remaining. The liberated sulphuretted hydrogen is conveyed to a furnace, in which it is passed over heated oxide of iron, to which latter is also admitted a regulated supply of air. The oxide appears to act as a medium for the extraction and deposition of the sulphur. Decomposing the sulphuretted hydrogen, it is yet prevented from itself forming a sulphide, owing to the continued admission of air; and the sulphur is thus liberated in the free state, and deposited in a series of settling chambers. The liquor containing the carbonate is subjected to a temperature of 180° to 200° Fahr, at which it loses the bulk of the carbon dioxide. The purified ammoniacal liquor is then distilled, and ammonia gas liberated, which is then ready for the reception of further quantities of unpurified gas containing sulphur compounds. The carbon dioxide driven off from the heated liquor before mentioned is utilized in the decomposition of the ammonium sulphide contained in the freshly saturated liquor.

We may now proceed to consider some of the mechanical details of the various appliances in use for carrying on the work of liquor purification.

The Washer.—The essential principles of a good washer have been indicated in the paragraph given above with reference to the elimination of the last traces of tar. They are all embodied in such washers as Cathels's, Anderson's, Livesey's, and others. As typical of such apparatus we may take Livesey's washer; and a reference to the section thereof which constantly appears in the advertisement columns of the JOURNAL will assist the student in following the brief description here given. It is a rectangular cast-iron box, into which is kept continuously running, and at a constant level, ammoniacal liquor from the scrubber. The space above the level of the liquor is divided into an inlet chamber, running the whole length of the vessel, and occupying about two-thirds of its width, and two outlet chambers running parallel with the inlet chamber—one on either side, and separated therefrom by vertical plates or diaphragms. In free communication with the two outlet chambers there are fixed between them a series or tier of horizontal rectangular tubes one inch apart. To the lower edges of the sides of the tubes are fastened finely perforated plates, which have been so bent that their section would almost represent an isosceles triangle, whereof the base is uppermost, and forms the bottom of the rectangular tube, and the equal sides of which form, as it were, a continuation of the sides of the tube turned downwards, and inclined towards each other until they nearly meet. The lower part of the tubes dip into the liquor, so that the bent portions, and also the horizontal bottom of the tubes, are therein immersed. The gas passes from the inlet chamber to the space between these tubes, and is forced through the perforations in the bent dips, and upwards again through the perforated bottoms of the tubes into the spaces inside the tubes. Passing along the latter, it readily finds its way, right and left, into the outlet chambers. The gas is thus twice broken up in its passage through the apparatus, and is found to emerge perfectly free from tarry matter. The apparatus may be used

separately in a cast-iron case, or, as is usually the practice with this and similar washers, it may be fixed at the bottom of the scrubber—being fed directly by the liquor from above.

Washers give a certain amount of back-pressure. The gas is forced to pass *through* the liquor, and the operation is accomplished thus: The pressure of the gas from the retorts (assisted by the exhauster) depresses the liquid to the depth of the orifices through which the gas must pass. Once through them, it bubbles up through the liquor (as from the dip-pipes in the hydraulic main), and is free again. The pressure necessary to thus depress the liquor depends upon the depth to which the perforations or serrations may be immersed in the liquor—2, 2½, or 3 inches, as the case may be—and represents the back-pressure put by the apparatus on the passage of the gas in its onward course. It is the exact equivalent to the pressure required to support a column of water of the depth named in an ordinary U-tube pressure-gauge. Most of the apparatus employed gives more or less back-pressure.

The *Scrubber*, in its simplest form, is a cylindrical tower, in height seven or eight times its diameter. As already noted, the washer is often placed at the bottom. From this upwards the scrubber is filled with broken coke, brickbats, or other porous matter; or by horizontal tiers of rough sawn boards, placed on edge about ¼ inch apart—the boards in each tier crossing those immediately below. Tower scrubbers are best worked in pairs. Ammoniacal liquor from the hydraulic main and condensers (rich in free ammonia, and comparatively weak in salt), and also the weak liquor from No. 2, is passed over No. 1, and extracts the bulk of the ammonia and much of the other impurities, as already described. The liquor can be worked over and over again until it is fully saturated. The second scrubber is supplied with clean water, to free the gas from the remaining traces of ammonia. It also extracts small quantities of carbonic acid and sulphuretted hydrogen.

An important essential to the successful working of the tower scrubber is the thorough wetting by the liquor of the whole of the material contained therein, so that the gas may at every hand be constantly confronted with freshly wetted surfaces. To ensure this, provision has to be made at the top of the scrubber for evenly distributing the flow of liquor or water. This may be secured by a Barker's mill, a turbine, or a series of radiating arms actuated by outside machinery. The gas enters at the bottom of the scrubber, and, having ample space, it can leisurely find its way through the wetted material upwards to the top of the vessel, where it enters the outlet-pipe, which passes downwards inside the scrubber. The liquor or water entering at the top meets the upward currents of gas, and flowing downwards, gains strength in its course; ultimately leaving the scrubber at the bottom by a suitably trapped outlet. The tower scrubber is thus automatic and very effective in its action. The large area it presents to the gas allows of the latter proceeding upwards very leisurely—the "slow speed" thus attained being the *desideratum* of successful scrubbing; and the writer much doubts whether it is possible for the more complicated machinery of the washer-scrubber to practically improve, in simplicity, economy, and effective duty, on the work of twin scrubbers supplemented by an efficient washer of the type already described.

The consideration of washer-scrubbers must be deferred.

(*To be continued.*)

TECHNICAL RECORD.

SOCIETY OF CHEMICAL INDUSTRY.

The Annual Meeting and Excursions.

The Annual General Meeting of this Society was held in London last week. The proceedings were opened by the President—Professor J. Emerson Reynolds—at the Drapers' Hall, Throgmorton Street, on Wednesday afternoon, when the usual business of receiving the report and accounts, electing officers for the ensuing year, &c., was transacted. The President delivered an Inaugural Address, in the course of which he referred to the possible exhaustion of our coal supply, and the economy that would follow a more general adoption of gaseous, in preference to solid, fuel. In the evening, a reception was given by the President in the Galleries of the Royal Institute of Painters in Water Colours, Piccadilly. This was followed by a smoking concert, at which an excellent programme of glees, songs, &c., was rendered, under the personal direction of Mr. J. C. Butterfield.

Thursday was devoted to a river excursion to the works of the Lindé British Refrigeration Company, at Shadwell, the Union Oil-Mills and the generating station of the London Electric Supply Corporation, at Deptford; and to the works of Messrs. Easton and Anderson and the Maxim Nordenfelt Gun and Ammunition Company, at Erith. The refrigeration works are interesting, as illustrating a field for the use of ammonia; and they comprise boiler-house, engine and refrigerator room, condenser-room, freezing-tank rooms, ice-store, and an extensive cold store. The plant is believed to be the largest in existence, and is equal to the production of 150 tons of ice per 24 hours. The Lindé system is based on the evaporation of liquid anhydrous ammonia, which boils at − 28° Fahr., and possesses the advantages for this purpose, of a high latent heat of vaporization, a low specific heat, and convenient condensing pressure. The heat necessary for the evaporation of this liquid is abstracted from surrounding bodies—in this instance, brine; and the vapour is then, by means of compression and contact with a surface condenser, brought again to the liquid form at a temperature dependent upon that of the cooling water available. The liquid passes back to the refrigerator, and the same small quantity of ammonia is used over and over again. The apparatus consists of a double-acting pump for compressing the vapour; the condenser, consisting of coils of wrought-iron tube placed in a cylindrical water-tank; and the ice generator, which is a wrought-iron rectangular tank filled with brine. In the bottom part are the refrigerating-coils, through which the brine, which has been cooled as above mentioned, is caused to circulate; and above them are the moulds, suspended from frames running on wheels along horizontal rails, in which the ice is formed. The rows of moulds are worked forward from one end of the tank to the other, a row of finished ice-blocks being extracted, the remainder moved a step forward, and a row of moulds freshly charged with water put in at the other end. The blocks of ice produced are either 3 ft. 3 in. long by 14 inches square (2 cwt.), or 3 ft. 3 in. by 14 in. by 7 in. (1 cwt.). There is also crushing machinery, as large quantities of crushed ice for fishing boats are supplied by the Company. The cooling stores are kept at the desired temperature by overhead pipes, through which cold brine is circulated, and also by cooled air driven in by a fan.

The visit to the generating station of the London Electric Supply Corporation had been looked forward to with much anticipation, as so much has lately been heard about the wonderful things that were being done at Deptford. But the general feeling, after the inspection, was one of disappointment. In view of the large sums that had been laid out by this Company, one naturally looked, not necessarily for superfluous ornamentation, but for something interesting in the way of well-designed buildings and sets of machinery. But, as a matter of fact, the plant is only a magnified country-house installation. It is big—partaking somewhat of the clumsiness and ungainly proportions of a giant. It comprises a rectangular boiler-house, containing rows of Babcock tube boilers, and a coal jetty on the bank of the river. Two remarkably ugly chimneys, fashioned like Brobdignagian dwelling-house chimney-stacks without the pots, are placed one at either end. Adjoining this is the engine and dynamo house—a very lofty, plain, rectangular building, containing two 600 and two 1500 horse power Corliss engines, each driving a Ferranti dynamo. The engines run at 90 revolutions, and drive the dynamo at 250 revolutions per minute, by the medium of cotton ropes as belting, on grooved pulleys. They are fitted with small starting-engines, by means of which they can be driven at slow speed when no power is being taken from them. The two large plants are somewhat cramped together at one corner of the building; and between them is a striking summer-house-like structure, that looks oddly out of place, in which the conductors from the four sets are brought up to the switchboards, from which the four conducting-lines, which convey the current to the distributing-stations, situated in the heart of the districts supplied, take their start. The current from the large machines has a strength of 10,000 volts, and passes direct to the conductors; but that from the small sets is only 2400 volts, and is first passed through transformers, and brought up to 10,000 volts. The conducting-lines are similar in structure, and consist of two concentric copper tubes about ¾ inch and 1¾ inches in diameter respectively, kept apart by means of strongly-compressed brown paper, saturated with ozokerit, as an insulating material. There is a core in the inner, and also a lapping of the material round the outer tube; and the whole is enclosed in a steel tube about 1½ inches in diameter. There are 28 miles of main conductor, and at the distributing-stations the current is transformed down to 2400 volts before being conveyed to the consumers; and at the entrance to each house, it is again brought down to 100 volts. The reason for conveying it at such high intensity is to economize the cost of conductors. Apparently the building was not designed for the machinery which at present occupies it, as there are large vacant spaces used for stores and as workshops. Or perhaps it was deemed advisable to leave room for extensions.

At Erith the members of the party were entertained at luncheon by Mr. C. Beadle, whose kindness was suitably recognized by the President, and by Mr. T. Tyrer, the Chairman of the London Section of the Society. At the works of Messrs. Easton and Anderson an electric turning-machine attracted a great deal of attention. A steel wheel, running at 6000 revolutions per minute, and also charged with an electric current, is brought into contact with the wheel or other piece to be turned. At the time of the visit, the running edges of a pair of railway-waggon wheels were rapidly reduced to proper proportions, with the accompaniment of a terrific humming, showers of beautiful golden sparks, and a lightning-like blue flame too intense for the naked eye.

After the visit, the members repaired to the "Ship" at Greenwich, where the annual dinner took place.

The following day was occupied by a pleasure trip to Windsor and Clieveden. The weather each day was all that could be desired; the attendance was good; and the whole proceedings were a decided success.

SOCIETY OF ENGINEERS.

Last Wednesday, the members of this Society visited the works of the Southwark and Vauxhall Water Company at Hampton, and those erected by the Native Guano Company for treating the sewage of Kingston. The party was accompanied by the President (Mr. J. W. Wilson). The following particulars of the works were supplied by the Secretary (Mr. G. A. Pryce Cuxson):—

The Hampton works of the Southwark and Vauxhall Water Company were commenced in accordance with the provisions of the Metropolis Water Act, 1852; the first supply being pumped from Hampton to Battersea, to be there filtered and distributed, on July 5, 1855. In 1867 additional works were commenced on the adjoining land, having for their principal object the supply of the western portion of the district. These were completed and brought into use in the spring of 1870. The details of the present arrangements are as follows: A portion of the supply is conveyed through a 48-inch pipe to the subsiding reservoirs; from thence pumped by three engines of the direct-acting or "Bull" type through a 36-inch trunk main, under a head of 135 feet, to the Company's works at Battersea, where it undergoes a further process of subsidence and filtration before it is again pumped to the district for distribution. Another portion is conveyed through a 36-inch conduit to three filters, having an area of 3¼ acres. It is not usually necessary to admit water at this point, as the supply to these works is supplemented by several million gallons per diem from the natural filtration works hereafter described. It is then pumped by two sets of direct-acting rotative compound engines, against a head of 275 feet, for delivery through 30-inch and 42-inch trunk mains partly to the reservoirs at Nunhead and partly direct to the district. A pair of Cornish beam-engines are kept in reserve for the supply of the 30-inch main. The supply of water obtained from what is called the natural filtration system occupies two fields and an island, having a total area of 39¾ acres. The river water is admitted to these two fields through a vertical gravel filter; and the gravel subsoil is thus charged by a system of glazed earthenware pipes, 24 inches in diameter, laid with open joints. The water, after having percolated through the sand and gravel, is collected by a system of 24-inch earthenware pipes, laid with open joints on the surface of the clay. It is then conveyed through two 36-inch conduits to the engine-house, and delivered to the filters before referred to. Of the three direct-acting engines, Nos. 1 and 2 have cylinders 66 inches diameter, with 10-feet stroke, and pump-holes of 39 inches in diameter; and No. 3 has a cylinder 70 inches in diameter and 10-feet stroke, with a pump plunger 42 inches in diameter. These engines are supplied with steam at 40 lbs. pressure per square inch by 13 boilers of the Cornish single-flued type; six of these being fitted with Vicar's mechanical stokers. The compound direct-acting engines of the surface condensing rotative type are arranged in two pairs, having cylinders 32 inches and 52⅜ inches in diameter and 7-feet stroke, with two double-acting pumps, 19 inches in diameter and 7-feet stroke, working against a head of 275 feet. These are supplied with steam, at 100 lbs. pressure, by six double-flued Lancashire steel boilers, 28 feet long and 7 ft. 6 in. in diameter. The engines of the Cornish beam type have cylinders 80 inches in diameter, with 10-feet stroke. The pumps are double-acting, 24¾ inches in diameter, and have the same stroke as the steam piston. They usually work against a head of 240 feet. Steam is supplied by 11 single-flued Cornish boilers, at a pressure of 40 lbs. per square inch. The engines for lifting the water obtained from the natural filtration works are arranged in two pairs. No. 1 is a compound jet condensing engine, with cylinder 17 inches and 32 inches in diameter, and 2-feet stroke; No. 2, a tri-compound surface condensing engine, having cylinders 9, 13½, and 27 inches in diameter, and 2-feet stroke. Each of these engines is geared in the ratio of 4 to 1 to a set of three single-acting bucket-pumps, 3 feet in diameter, and 50-inch stroke; each set being capable of lifting 16 million gallons per 24 hours. These engines can be supplied with steam either from the Cornish boilers connected with the direct-acting engines or from a De Naeyer water-tube boiler, which, when the tri-compound engine is in use, is worked at a pressure of about 150 lbs. per square inch.

The Kingston sewage works were constructed for treating, by the "A.B.C." process, the sewage of 35,000 people; but with certain comparatively inexpensive additions, they will meet the requirements of a population of 50,000. At present the sewage being treated is that of Kingston, with a population of 27,057; Surbiton, with one of 10,052; and Hampton Wick, with one of 2378—making a total of 39,487. The Kingston sewage, on reaching the works, passes into the screening chamber, and through a grating, which intercepts coarse matter likely to choke or injure the pumps; and thence through a culvert to a pump-well under the main building, where it receives the "B.C.," or deodorizing and purifying mixture. The sewage thus partially treated is raised about 12 feet by centrifugal pumps, of which there are three; each driven by a 15-horse power engine, and capable of lifting 1650 gallons per minute. The pumps discharge into a meter chamber, where the sewage is measured, and the quantity registered. On leaving the meter, it flows along an open channel to the settling-tanks; receiving on its way the precipitating agents. There are eight tanks, each 85 feet long by 50 feet broad, and of 6 feet average working depth, holding 150,000 gallons, or 1,200,000 gallons in the aggregate, which gives a capacity of 30 gallons per head for a population of 40,000. The treated sewage flows in a continuous stream through the tanks, precipitating as it flows, and passes clear, bright, and odourless into a covered channel discharging into the Thames. The tanks are cleaned periodically; the deposit or sludge being pumped into the sludge-well by a double-action pump at the rate of 500 gallons per minute. From this well the sludge is first drawn into six sludge vessels, or accumulators, by the creation of a vacuum; and it is then forced by air pressure, at 100 lbs. on the square inch, into filter-presses on the first floor of the building, from which it is removed in hard cakes. There are three air-pumps and sixteen filter-presses. The pressed cakes are dried in a drying cylinder (with fan and condensing apparatus attached), ground into powder, bagged, and sold as native guano at £3 10s. per ton. The Surbiton sewage is separately received and screened, and is pumped by centrifugal pumps, through a meter, into the Kingston pump-well. There are three pumps, each driven by an 8-horse power engine, and capable of lifting 750 gallons per minute. The boilers are of the locomotive multitubular type, working at a pressure of 150 lbs. per square inch—one of 80-horse, and two of 60-horse power each. The two main driving engines, each of 40-horse power, are used alternately. Two mortar-mills are employed for grinding the chemicals, which are then mixed in vats, and discharged into the pump-well; and there are two vats for dissolving the precipitating agents. A small centrifugal pump supplies water from the river for the boilers, mixing the chemicals, &c.

WESTERN (U.S.A.) GAS ASSOCIATION.

The Annual Meeting at Detroit (Mich).

(*Concluded from p.* 76.)

A paper entitled "New Features in Routine Office Work of Small Gas Companies," descriptive of the system adopted by the author, was read by Mr. W. Lee Brown, of Evanston (Ill.) The meter-statement book carried by the inspector who reads the indices consists of a paged journal, having on each page the name, address, folio, and size of meter, and ruled spaces for the meter index and consumption during six months. In this book the consumers are entered in tabular form (about 40 on a page), and the meters are taken, and accounts rendered monthly. At the time of reading the meter, the inspector makes out and leaves a slip stating the quantity of gas consumed, and the sum due; and if this account is paid at the office before the 10th of the following month, a discount of 25 per cent. is allowed by the Company. The size of the slip is 6 in. by 3¼ in., and the word "Gas" is printed in large red letters across both the face and the back, with the view of avoiding its loss or accidental destruction. Proper gas bills are made out, and retained at the office. They consist of slips 10½ in. by 3⅜ in., adapted for use with one of the Felt and Tarrant coupon cutters—a machine which at one operation stamps a receipt on the bill and detaches a counterfoil. The counterfoils fall into a receptacle; and at the close of the day they can be reckond up, and made to furnish a check on the cash taken. The bills are of the ordinary kind, showing the full address of the Company, meter index and consumption, and terms of payment; and they also have spaces for receipting, and for memorandums showing date of delivery of the slip, or of a duplicate. To save time in writing out bills, a series of rubber stamps is provided, one for each customer; and these are arranged in drawers, each of which represents two or three pages of the meter-statement book, and is labelled accordingly. The drawers are divided into spaces for the stamps. In the bottom of each drawer is a sheet of blotting-paper moistened with glycerine, on which the stamps rest when they are not in use. By means of this arrangement, 1700 bills for 750 customers are stamped, both on the body and on the coupon, in about an hour. The surname is put first, on the stamps—thus: "Smith, John"—for convenience in reference; and the stamps also carry the meter-book folio. The meter-index and consumption are written; but a series of about 120 stamps enables the gross amounts, discounts, and net amounts up to £4 10s. to be stamped. Larger sums, which are exceptional, can be written in. This stamping again represents a great saving of time as compared with writing the figures. Duplicate bills are promptly sent to those who desire them; and statements of the whole of the unpaid accounts are rendered on the 15th of each month. For facilitating reference to any customer, a series of "consumers' directory cards" are kept in alphabetical order. Each card gives the name, address, meter-book folio, and ledger folio. The paper was illustrated by diagrams of the bill forms, &c., referred to.

Mr. G. T. Thompson observed that Mr. Brown enjoyed the advantage of gas at the even rate of $2 per 1000 cubic feet, and a 25 per cent. discount, which gave even numbers to deal with. Much difficulty would arise with a less easy system of figuring; and he thought the plan of leaving slips placed too much reliance on the accuracy of the under-inspectors. The coupon cutters referred to in the paper were excellent appliances. Four of them were used in the office at St. Louis; and as many as 8000 accounts had been received in one day.

The next item was a paper by Mr. W. A. Stedman, of St. Louis, on "Every-Day Gas Analysis." It consisted of a description of the apparatus known in England as "Cooper's tube," and its application for absorbing sulphuretted hydrogen and carbonic acid from coal gas, and carbonic oxide and oxygen from water gas; and it gave rise to a short conversational discussion.

Mr. K. M. Mitchell, of St. Joseph (Mis.), contributed a paper on "Fuel Gas Viewed through a Coal Gas Man's Spectacles." In comparing cheap non-illuminating gas with coal gas, the author first noticed its poisonous nature, due to the presence of a large proportion of carbonic oxide. He insisted upon the importance of giving it a distinctive odour, by which the existence of leakages could, he said, be immediately detected; and he passed on to enlarge on the relative heating value of the two gases. Since that of water gas was less than half that of coal gas, it followed that, to produce similar effects in equal times, distributing mains, services, supply-pipes, and meters would have to be twice as large in the former case. After giving an instance in proof of the assertion that fuel gas at 2s. 1d. per 1000 cubic feet could not compete in price with solid fuels, he arrived at the conclusion that cheap coal gas was the most likely solution of the gaseous fuel problem.

Discussion being invited, Mr. Evans challenged several points in the paper; arguing that, in practice, fuel gas was capable of affording much better results than those set forth. Mr. Lansden pointed out that, in the case of a city depending entirely upon gas for heating purposes, the consumption would be extremely uncertain and variable, necessitating large storeage capacity. Mr. J. Young said he had been engaged for some years in the supply of natural gas—first by contract, then at 4d., 5d., 7½d., and now at 10d. per 1000 cubic feet by meter. The introduction of meters and the increase of price stimulated the introduction of economizing appliances, but did not lead to a loss of consumers, though some had partly discontinued its use. According to the author's examples, natural gas at 10d. per 1000 cubic feet was considerably cheaper than solid fuels. People would not go to any great expense for appliances required in the use of natural gas because of the uncertainty as to how long the supply would last. Mr. Somerville referred to some tests made by Mr. Cowdery with fuel gas at Chicago, which gave a heating value a little higher than that quoted in the paper. Fuel-gas people were apt to forget, too, that even with gas there must be considerable waste of heat by way of the flue, and otherwise. The President spoke in favour of the accuracy of the experiments as described in the paper. According to some practical tests he had made in using coal gas for warming a dwelling, it appeared that, as compared with hard coal at 25s. per ton, the gas was only worth 1s. 3d. per 1000 cubic feet. Mr. Egner referred to an unsuccessful endeavour to introduce fuel gas at 2s. 1d. per 1000 cubic feet at St. Louis; but he added that, for other than domestic purposes, the gas was always a success. Mr. Coverdale quoted several facts in regard to the introduction of fuel gas in different places, which appeared favourable to its extended use; and he advised everyone to investigate the matter for himself.

Mr. W. H. Odiorne, of Springfield (Ill.), read a paper on half-depth regenerator furnaces for firing with cheap coal. In 1889 three benches of six retorts each, on this principle, were erected for him by the Parker-Russell Manufacturing Company. The arches were 12 feet high, 7 ft. 8 in. wide, and 9 ft. 4 in. deep; and the retorts were 9 feet long, and 15 in. by 26 in. in diameter. The flues and fire-box were large; the primary air supply entered below, and the secondary air supply above the fuel, after travelling three times the length of the setting. A pit was constructed in front, for working the furnaces, the floor being on a level with the ash-pan. It was covered with iron plate; and a trap-door afforded means of access. On first starting these furnaces, considerable difficulty was found in maintaining a good heat, and avoiding the accumulation of soot in the setting, when firing with cheap coal, though they would go well enough with coke. A jet of steam introduced under the fire-bars was found to be a great help. It kept the clinker from melting, and thus facilitated its removal. The secondary air supply was at last opened to the full extent; and then the furnace worked well. The pit in front, which was only 6 feet wide, was found too small to admit of comfortable clinkering, cleaning flues, &c. The stokers preferred coal to coke, as it called for less attention. But there was considerable evolution of smoke from the chimney for a few minutes after firing; and therefore, when the wind was in a particular direction, it was necessary to use coke, to avoid nuisance. The benches were in operation for upwards of two years, doing five charges of 325 lbs. each per day. Each bench required 1⅓ tons of coal per 24 hours for firing, or 7 bushels per ton of coal carbonized. Being satisfied with the system, he had six more benches of similar size, on the Mitchell system, erected. In these the fire-box was 4 feet high and 4 feet deep, 18 inches wide at the bars, extending out to 34 inches. Between the door and the bars, there were three step grates, on which a stream of water was allowed to flow; and a separate chimney, 13 in. by 18 in. in section, to each furnace. Profiting by previous experience, he provided a working pit 10 ft. by 7½ ft., and 2 ft. 6 in. deep below the ash-pan for each furnace. In these furnaces, small coal or slack could be utilized; and he was at present using slack purchased in the neighbourhood for ¾d. per bushel.

In the course of the discussion on the paper, Mr. Murdoch said that he worked the Mitchell benches with very satisfactory results, on slack coal; and he could get just what heat he chose. His yield of gas per ton of coal had been increased nearly one-third since using the Mitchell furnace. With retorts 9 feet long and 14 in. by 24 in. wide, he had nearly reached a production of 9000 cubic feet per retort per 24 hours with Pittsburgh coal. The weight of coal used for fuel was about one-third of the entire bulk carbonized. He employed nothing but Streator slack, which cost 4s. per ton, for fuel. Mr. Thompson said he had in use at present 30 benches of fives, on the Mitchell system, and fired them with Illinois nut coal, which cost 4s. 7d. per ton on the works. He found that 1350 lbs. of the coal would do the work of 1000 lbs. of Pittsburgh gas coke, which was worth 3¼d. per bushel. Once a week he fired with coke for a few hours; and this burnt out any soot that might have accumulated. He also used moveable steam-pipes for blowing out the flues. The retorts were 8 ft. 3 in. long and 14 in. by 22 in. wide; but he could get as good a yield as Mr. Murdoch by using from 290 to 300 lbs. per charge, with oil as an enricher. He fired once an hour, stirred up the furnace, removed loose ashes, &c., six times, and clinkered twice every 24 hours. One man attended to ten furnaces, not including the firing, which was done on the stage floor. Mr. Lynn had used the Mitchell furnace very successfully. Firing a bed of six retorts with a cheap native coal at 4s. per ton, he worked off 2200 lbs. every four hours; averaging 2500 lbs. of coal used per 24 hours as fuel. The retorts were large—10 ft. by 17 in. by 30 in. Mr. Tracy said he could get a better heat from nut coal at 3s. 9d. per ton than from coke.

Mr. Odiorne, in replying upon the discussion and to questions, said he obtained a yield of 4·75 cubic feet per pound of Pittsburgh coal with a little cannel, and 3·25 cubic feet per pound from native coal. The coal became very hot at the back of the furnace; but it remained dull in front. He fired every hour; and the smoke rolled out in large volumes for five to ten minutes after firing. He clinkered four times a day; the operation occupying about five minutes each time. He did not use supplementary bars, as the coal formed a bridge in the grate, and the clinker, ash, &c., could be drawn away quite easily. If a lot of the fire was pulled out, there would be a loss of heat at each clinkering; but this was not the case with him. When working large charges, the fire was loosened and stirred two or three times between each firing, to make it burn freely. He could use cannel coke in his furnace; but it produced more clinker.

A paper on the "Origin of Coal and Petroleum," contributed by Mr. A. E. Forstall, of Newark (N.J.)., was read by Mr. Ramsdell, in the author's absence. It was a well-written paper; displaying considerable research. The theory of the vegetable origin of coal was fully described; also the inorganic and the organic formation of petroleum—the latter being favoured by the writer.

After several expressions of satisfaction with the paper, and admiration for the ability displayed by the author, the meeting proceeded to hear a communication by Mr. B. E. Chollar, of St. Louis, (Mo.), entitled "Practical Photometry Simplified for Daily Use." He said he thought that the common batswing and union-jet burners would remain the principal appliances for the combustion of gas; and he directed attention to the very great difference between the duty actually obtained, and the theoretical capabilities of gas—showing that only a small percentage of the total energy was obtainable in the form of light. Comparing various sizes of lava-tip burners with Sugg's standard Argand burner, he found a considerable loss of efficiency in the smaller, and also in some of the larger burners. His experiments were noticeable as showing considerable variation in the efficiency of burners that were nominally of the same size and make. Some old burners tested for consumers gave very poor results indeed—in some cases less than 20 per cent. of the proper duty. These were tested with the globes on, as in ordinary use. The author described what he called an "efficiency photometer." It was fitted with a gas supply at either end of the bar, with a separate meter, &c., so that a standard burner could be used at one end, and the burner to be examined at the other. A valve was so arranged that the meters could be started or stopped simultaneously.

The paper was followed by a considerable amount of discussion and questioning; and, in replying, Mr. Chollar said he did not believe in weighing his candles. The English standard candle would burn exactly 2 grains per minute when the height of the flame was 1 ⅛ inches. He carefully adjusted the flame to this height, by clipping, or allowing the wick to lengthen, as might be necessary—putting on a pair of smoked glasses while doing so; and when this condition was obtained, one reading was as accurate as ten taken in the usual way. As long as the flame remained at this height, the reading would be the same. He believed in having a special department for looking after the consumers' burners; and he preferred check burners, suitable for the particular locality, to governor burners.

"The Advantages of Recuperative Furnaces in the Utilization of Heat" was the subject of a paper read by Mr. F. Bredel, of Milwaukee (Wis.), who claimed for that system a saving of fuel, labour, floor space, and wear and tear, as compared with ordinary settings. On the first head, he assumed that a grate furnace requires an excess of 66 per cent. of air, and that the products of combustion leave the setting at 1850° Fahr. In the

recuperative furnace, about 10 per cent. excess of air was sufficient; and the products of combustion would be cooled to 680° or less before leaving. By means of calculations fully worked out in the paper, he showed that the loss in the first case would be 71 per cent., and in the second only 20 per cent. of the total heat produced. The question of flame temperature was next completely followed out; the result being 2690° for the grate furnace, and 4370° for the recuperative furnace, and 3540° for a generator furnace in which the air supply was not heated. For 100 lbs. of coke used in a regenerator setting, 156 lbs would be required for a generator, and 272 lbs. for the ordinary grate furnace. The loss by radiation he put at about the same for any kind of furnace. The heat actually absorbed in the distillation of Youghiogheny coal he had determined by practical experiment to be equivalent to that afforded by 10½ lbs. of coke. After allowing for loss by radiation, carbon in the clinker, &c., the best possible result in working would be a consumption of 7⅛ lbs.; so that the practical result was an efficiency of 71 per cent. Generator furnaces only gave 46, and grate furnaces only 26 per cent. efficiency. Since high flame temperature was the thing required, he showed that carbonic oxide was more useful in the furnace, as giving 4300° Fahr., than hydrogen, which only gave 3640° Fahr. He claimed an economy of some 30 per cent. in floor space and wear and tear, having regard to the quantity of gas made, for the regenerator furnace; while the first cost would not, he said, be more than 10 per cent. In all, he contended that a saving of about 4½d. per 1000 cubic feet of gas made could be secured by replacing grate furnaces with regenerative ones.

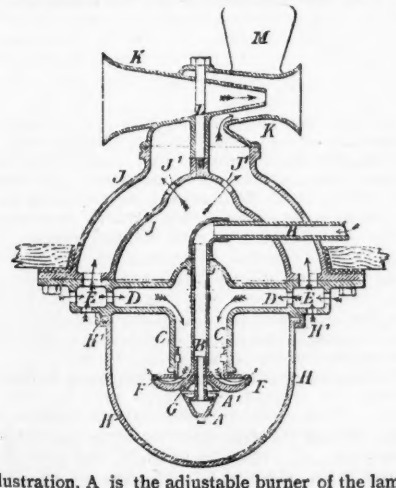
Discussion being invited, Mr. Dunbar attacked some of the figures given in the paper; dwelling especially on the increased first cost of the regenerator furnace, which he considered to be nearer 100 than 10 per cent.

The "question-box" was next opened, In reply to an inquiry, "Does it pay to dispense with stopcocks and boxes on service-pipes?" various opinions were expressed; some members saying they were not of much use, and others dwelling on the advantages afforded by them in case of fire or refractory customers. The question, "In revivifying oxide *in situ*, is it best to use steam?" was discussed at some length. Steam was advised as a means of keeping down the temperature in the case of new or active oxide; but some members were able, by carefully regulating the air supply, to do without it. The query, "Are gas companies that own and operate electric light plants satisfied with the profits earned in that department of their business?" was received with cries of "No!" from all parts of the room. Mr. Gwynn ascribed the cause of much of the dissatisfaction to careless construction and mismanagement. The only way to make money by electric lighting was, he said, to have the best possible apparatus and plant. Mr. Doan had operated a combined plant for about seven years, with satisfactory results. Several other questions were discussed; and the meeting then came to a close,

REGISTER OF PATENTS.

Lighting and Ventilating Railway Carriages.—Potter, W. G., of Manchester. No. 11,511; July 7, 1891.

An important feature of this invention is the combination of a regenerative gas-lamp and a ventilator, in such a manner that the air in the upper part of the railway-carriage will be drawn into the apparatus; and a part of it will be drawn downward towards the burner and heated, at the same time, by the products of combustion, whilst a further portion will pass through the ventilator. Another feature of the invention is the combination of an adjustable burner for producing an annular flame; and a cone or deflector for the heated air, so arranged relatively to the burner that the heated air will impinge upon the flame as the latter turns towards the chimney of the lamp.

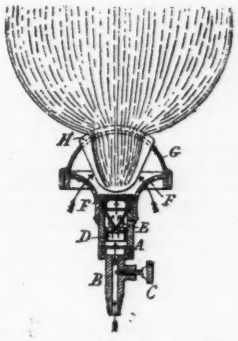


In the illustration, A is the adjustable burner of the lamp, screwed o the gas supply-pipe B. C is a chamber or tube through which the pipe B extends, and which is connected by radial tubes D with a perforated annular chamber E. In the lower end of C is secured a cone or deflector F, made of steatite or other refractory material; and beneath it is a disc or nut G, which is screwed upon the hollow stem of the burner, and serves as a lock-nut for securing the burner in any position to which it may be adjusted. Through the space between the underside of G and the turned-up edge A^1 of the burner, the gas passes so as to produce an annular flame. The size of the flame can be regulated by adjusting the burner A and disc G. The lamp is provided with a glass globe H, supported by a metal hinged ring H^1. J is a dome-shaped casing, secured to the main body of the lamp. The inner wall of the casing is perforated at its upper end, as at J^1, and serves as the chimney of the lamp. The space between the two walls of the casing forms a ventilating passage, in communication at its lower end with the annular chamber E, and at its upper end with the passage for the induced current through a cowl K, constructed upon the injector principle. The cowl is mounted upon a pivot L, and is provided with a vane M, so that it will turn automatically to accommodate itself to the direction in which the carriage is travelling.

The operation of the apparatus is as follows: The gas issuing from the burner A, when ignited, produces an annular flame, which impinges against the cone or deflector F. The products of combustion pass upward around the tubes D and through the apertures J^1 into and through the cowl K. Air is drawn from the upper part of the railway-carriage into the annular chamber E; and a portion of this air is drawn through the tubes D and C, and flows from the cone or deflector F in such a manner that it impinges upon the flame from the burner, at the same time keeping the deflector cool. The air as it passes through the tubes D and C, and the gas as it flows through the pipe B, are, on their passage to the burner and deflector, heated by the products of combustion; thus promoting the combustion of the gas and intensifying the light. Air is also drawn from the annular chamber E through the ventilating passage between the walls of the casing J, by the action of the cowl while the railway-carriage is in motion.

Gas-Burner.—Potter, W. G., of Manchester. No. 11,734; July 10, 1891.

The special features in this improved gas-burner are: (1) A self-regulating appliance; (2) an attachment designed to spread the flame "so as to increase the size of the flame and the intensity of the light obtained;" (3) the supply of heated air to the flame; and (4) means for adjusting the burner by hand, to adapt it for use with higher or lower pressures.



A is a small cylinder or casing, provided with a hollow stem B, having at its lower end a taper screw-thread for connecting the burner to the supply-pipe in the usual manner. An adjusting-screw C is passed through a hole made in the hollow stem, and extends into the interior of it, for the purpose of regulating by hand the area of the passage for the flow of gas to the burner casing. There is provided an automatic regulator, comprising an annular piston or valve D, which works up and down in the cylinder, and a perforated inverted hollow cone E, forming a seating for the valve. The weight of the valve is such that the entering gas will raise it more or less, according to the difference of pressure above and below the valve; and thus regulate the flow of the gas through the burner. Should a rush of gas take place, the valve will be forced against the conical seating E; and the gas will then flow only through the small perforation in the apex of the cone, until the pressure above it increases sufficiently to permit the descent of the valve under the action of gravity. The upper end of the cylinder is perforated to permit the flow of the gas therefrom; a perforated disc of suitable refractory material being, by preference, fixed in the upper end for this purpose. Suitable perforated discs are, moreover, arranged in the cylinder, to serve as "strainers or filters" for the gas. On the upper part of the cylinder is fitted a perforated metal cup F, to which is secured a metal dome or deflecting-cone G formed with an elongated aperture or slit G^1 in the top. At each end of this aperture is formed a narrow slit G^2; and in these slits is fixed a flat plate or spreader H, made of metal or other suitable material, for the purpose of dividing and spreading the flame. The gas from the cylinder flows upward on both sides of the spreader and through the aperture G^1. Air for supporting combustion enters, through the perforations in the cup F, into the chamber formed between the cup and the deflecting-cone G, and flows through the aperture G^1 on both sides of the spreader; being deflected upon the flame by the cone. The flow of the air is thus concentrated upon the flame, says the patentee; the air being, moreover, heated to some extent in its passage through the chamber, so as "to produce a kind of regenerating gas-burner."

Gas-Engines.—Clerk, Dugald, of Sutton Coldfield. No. 12,413; July 22, 1891.

This invention relates to gas-engines of the "Otto" cycle; and its object is to simplify the valve arrangements, and dispense with the "two-to-one" gear at present used on such engines. The patentee proposes to dispense with the usual valve-shaft, rotating at half the

rate of revolution of the engine, and to actuate the exhaust-valve by means of air compressed by a small piston. This piston may be actuated from the motor piston, in which case air is compressed during the forward stroke of that piston, and admitted to a small piston or diaphragm connected to the exhaust-valve at or near the out-end of the stroke, through a port controlled by the small piston, or the engine piston, or a valve connected to either. The compressed air opens the exhaust-valve at the end of every second stroke when the engine is working at full power; and the "two-to-one" action is given by a small valve, rotated by a reciprocating pawl-and-ratchet wheel.

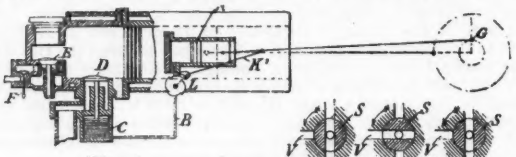


Fig. 1.

Fig. 2. Fig. 3. Fig. 4.

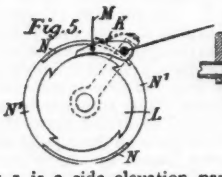


Fig. 5.

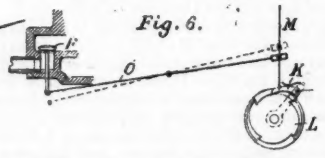


Fig. 6.

Fig. 1 is a side elevation, partly in section, showing this new gear. Figs. 2, 3, and 4 are sections showing different positions of the rotating-valve. Fig. 5 illustrates (on a larger scale) the pawl-and-ratchet wheel arrangement for rotating the valve. Fig. 6 shows a mode of connecting between the pawl and the gas-valve; so that when the pawl is raised out of gear by the governor, the gas-valve is closed.

The movement of the pawl K, on every second (that is, every "in") stroke of the engine, rotates the plug-valve S through a certain portion of the circle; and passages are so arranged in the rotating-valve that, every second return stroke of the small pump piston A, the cylinder is held open, and air is discharged, so that no pressure is accumulated to actuate the exhaust-valve D by its loose piston C. The exhaust-valve is thereby opened on every second return stroke of the engine piston. The small pump may be driven from an eccentric, whose centre is shown at G (fig. 1), or by radial gear from the engine connecting-rod, instead of by direct connection to the engine piston. This is an advantage, as the air supplied by the piston A to the loose piston C when it moves with the engine piston, must be retained in the exhaust-valve cylinder or chamber, under the piston C, until the exhausting stroke is finished. It is then liberated, when the engine piston has completed its back stroke, by a passage controlled through either of the pistons or some connecting-piece moved with them. When the pump A is driven from an eccentric or crank-pin on the crank-shaft, the compression of the air may be, and is, timed as shown in fig. 1, to open the exhaust-valve D, and allow it to close at the proper time without intermediate valves; only the ratchet rotating-valve S being required to cause the piston A to miss compressing the air at every second stroke, so as to give the "two-to-one" action. Suitable connecting passages B are arranged to convey the air under pressure from the small cylinder to a piston C, acting on the exhaust-valve D. The small air-compressing piston is preferably arranged to work without valves, other than that operated by the pawl K, and ratchet-wheel L; and it passes over an aperture in the side of the small cylinder to admit air, and permit the piston to move for a part of its stroke without compression. This aperture or gutter is cut in the cylinder at the end nearest the crank; and it is uncovered by the piston A when full out.

Instead of a rotating-valve, a lift-valve may be used to control the production of pressure in the small pump cylinder; and it may be intermittently actuated by a cam-shaft, rotated by a pawl-and-ratchet wheel. In either case, the piston A is caused to alternately compress air, and discharge it to the atmosphere. This is clearly shown at figs. 2, 3, and 4. In fig. 2 the ratchet-wheel L has been turned by the pawl K, to leave the passage open to the pipe B, but closed to the passage V leading to the atmosphere. The piston A thus compresses the air contained in the small cylinder, and forces the compressed air through the pipe B to lift the valve D by the piston C. When the ratchet-wheel has turned the valve S to the position shown at fig. 3, no pressure accumulates in the cylinder; as it is discharged to the atmosphere by passages in the plug-valve, and by the passage V. The valve D then remains closed, and a compression stroke occurs.

In this type of engine, the charge is preferably admitted by an automatic valve F, operated by the suction; and a gas-mixing valve E, also automatic, may be used below the inlet-valve next the cylinder. The gas-valve may be arranged to open at every opening of the exhaust-valve, and be held open by a catch or lever controlled by the governor, as shown at fig. 6; or the opening may be effected by the governor holding open the rotating-valve, to prevent compression of air. This may be effected by lifting the pawl out of gear, so as to leave the valve open, or by opening another valve by the governor. Sometimes the governing is accomplished by lifting out the pawl, so as to leave the rotating-valve shut; and in this case, the gas inlet-valve is closed by the governor, so that an air charge is drawn into the cylinder, and discharged at every revolution of the engine. An ordinary centrifugal governor may be adopted; and the link M may connect to that governor to lift the pawl K out of gear with the ratchet-wheel L. The disc N^1 carries a ledge N; and both disc and ledge rotate with the ratchet-wheel. The pin connecting the rod M to the pawl K is projected, so as to pass under the ledge N; and so long as it is under this ledge, the governor cannot raise the pawl K out of gear with L. When the ledge is passed, however, the governor is free to raise the pawl. The rod O connects between the link M and the valve F; and a pin in the link M slides under the rod O or in a slot in the rod, so as to allow of its oscillation with the pawl K operating by the rod K^1.

Purification of Gas.—Wise, W. L.; communicated from Solvay and Co., of Brussels. No. 13,550; Aug. 11, 1891.

This invention relates to the use of ferrite of soda for the removal of carbonic acid from illuminating gas; the patentees claiming to have discovered that ferrite of soda possesses the property of retaining even the slightest trace of carbonic acid contained in a neutral gas (such as atmospheric air or illuminating gas) passed over or through it; and that, after it has become saturated with carbonic acid, it can be readily regenerated, so as to again acquire its original properties.

Ferrite of soda suitable for this purpose can be prepared in the manner, and has the properties, described in patents No. 4364 of 1882 and No. 1974 of 1887. For the object here in view, it is sufficient to state that ferrite of soda can be obtained in the form of a brownish granular powder readily permeable by gases. Under the action of carbonic acid, the material becomes carbonated and converted into an extremely intimate mixture of carbonate of soda and ferric oxide; and this reaction will take place at the ordinary temperature. By heating this mixture to a temperature above 700° C.—as, for example, in a muffle furnace, or in a reverberatory furnace, or in rotary furnaces of the kind described in one of the inventor's former patents—the ferrite of soda can be regenerated for re-use. This operation is even much easier to effect than that of preparing the ferrite of soda in the first instance, because the mixture is a molecular one, and much more intimate than the physical or mechanical mixture originally used.

When applying this invention in a gas-works for the purpose of purifying illuminating gas, it will only be necessary to add a purifying box charged with ferrite of soda to the ordinary purifying plant, and to pass the gas to be purified through this box and the material therein. When the ferrite of soda has become inactive or spent, by reason of its decomposition by the carbonic acid in the coal gas, it is heated to a red heat (in a gas-retort, for instance), by which treatment it will be rendered fit for re-use. The ferrite of soda will also retain sulphuretted hydrogen present in the gas treated; but the resulting sulphide of soda cannot be so readily converted into ferrite of soda for re-use as the carbonate.

Controlling the Pressure in Water-Service Pipes.—Ross, W., of Glasgow. No. 13,780; Aug. 15, 1891.

This invention refers to apparatus to be applied to water service-pipes between the street-mains and domestic and other supply pipes, for controlling or relieving the pressure in the latter, and thereby preventing waste of water by leakage and otherwise.

The apparatus consists of a tubular valve-casing or barrel, interposed in the service-pipe and placed at right angles to it; the water inlet and outlet through the casing being formed in its sides at points not in line, but at some distance apart. A piston-valve (composed preferably of a leather washer secured between shoulders on a spindle) is fitted in a bored web formed in the barrel between the inlet and outlet orifices; and at the ends of the valve-spindle, similar valves are secured and fitted to the ends of the barrel or casing—the valves being of equal diameter, to ensure equilibrium of pressure. In a casing connected to the outlet-pipe, a diagram or like valve is fitted, to carry a spindle, on the outer end of which bears a weighted lever, centred on an arm on the casing, the opposite end of which lever is connected to the piston valve spindle.

In the operation of the apparatus, when water is drawn off from the supply-pipes and the pressure thereby relieved, the diaphragm valve drops, and with it the weighted end of the lever; the opposite end of the lever rising and lifting the piston-valve out of the bored web in which it is seated, so as to permit the free passage of water through the valve casing or barrel. When the water-tap is closed, and no water is being drawn from the pipe, the water pressure raises the diaphragm valve against the weight on the lever; the opposite end of the lever being thereby depressed, and the valve-spindle pushed down, until the central piston-valve enters the bored web and closes the passage through it for the water. By adjusting the weight on the operating lever, the extent of the pressure in the service-pipe, to effect the shutting off of the water supply, may be varied.

Gas Motor Engines.—Czermak, F., Bergl, A., and Hutter, H., of Vienna. No. 3292; Feb. 19, 1892.

This invention has reference more particularly to four-stroke cycle gas motor engines, wherein, at alternate outstrokes, the charging-valve is opened, and at alternate instrokes the discharge-valve is opened. Such engines are so constructed that only air is employed for effecting the cooling of the cylinders; and so the usual cooling water supply is dispensed with, which facilitates the application of the engine to small industries.

This cooling by means of air is effected, firstly, by providing the outer surface of the compression and explosion chamber with ribs for effectually giving off heat by radiation. Secondly, the transmission of heat from this part to the working cylinder is impeded by the interposition of a series of rings, composed alternately of good and bad conductors of heat. Thirdly, the piston is provided with a shield or head that is separated from the body by a layer of bad heat-conducting material. Fourthly, the motion of the piston is caused to force currents of cold air over the outer surface of the cylinder.

Gas-Fires.—Glegg, A., of Clerkenwell, E.C. No. 5032; March 15, 1892.

This invention consists in constructing a "portable" Bunsen gas arrangement of asbestos lamp, so as to permit of it being moved from fireplace to fireplace; provision being made for the raising and lowering of the burners, so as to suit the varying heights of the bars in different register grates.

Gas Motors.—Morani, F., of Rome. No. 6655; April 6, 1892.

This invention relates to motors in which the mixture of air and gas is compressed before explosion; and it has reference especially to

the mechanism for effecting the distribution and mixing the air with gas, and also to the governor and to the igniting device.

The distributing devices consist (1) of a casing containing a gas-distributing valve; (2) a casing in which works the valve which effects the distribution of the mixture of air and gas, or of the air alone; (3) the speed-governor; and (4) the actuating mechanism. The governor consists of a sleeve, provided with a pulley rotated by a belt from a pulley keyed on a counter-shaft. The sleeve surrounds a spiral spring, which has a tendency to oppose the action of the centrifugal force exerted upon the governor arms; and it rotates in a tubular part cast in one with the gas-valve casing. There is also a spring, which has a tendency to keep the end of a rod in contact with the end of the governor spindle; the other end of the rod being pivoted to a depending pin, extending down to a lever, and capable of oscillation.

If the speed of the motor exceeds a certain predetermined limit, thereby causing the angle between the governor arms to exceed that corresponding to the normal working of the motor, the point of the pin about which the lever oscillates will pass through a recess of the lever, and the valve will remain closed. When the governor arms are closed (which can only happen when the motor is at rest, or in the event of the governor belt breaking or slipping off suddenly), the point of the pin will pass through the recess of the lever and allow the gas-valve to close. For this reason, the recess can be dispensed with when the transmission of motion to the governor is effected by toothed wheels, in which case a small arresting sector, which is only employed in starting the engine, becomes superfluous. With distributing devices according to this invention, therefore, the two distributing valves act automatically by reason of the suction caused by the stroke of the piston—that is to say, the suction brings about the opening of the gas-inlet valve, which would otherwise have a tendency to remain closed under the action of suction.

The igniting device consists, as usual, of a metallic tube, enclosed by a sleeve or tube, and is heated by a flame to incandescence. Igniting devices of this kind are in general use; but according to this invention a differential piston is employed, one of its ends forming a valve, which moves automatically to-and-fro in a casing attached to the cylinder cover. The object of this arrangement is to allow a small quantity of the explosive mixture compressed in the cylinder to pass into the igniting-tube at the end of each compression stroke of the engine piston, for the purpose of causing the ignition of the whole quantity of gas which produces the motive power. The igniting-tube is screwed upon the main engine-casing, and so is in constant communication with the compression chamber of the engine cylinder.

Safety Gas-Cocks.—Clark, J., of San Francisco, U.S.A. No. 7800; April 26, 1892.

This invention relates to safety gas-cocks of the class in which provision is made for the automatic locking of the cock when turned to shut off the flow of gas, so as to provide against an accidental carrying of the key beyond its line of centre in either direction, and consequent escape of gas. It has for its objects, among others, to provide an improved construction in which there is an actuated catch in contradistinction to a stop lug and pin, which is moveable from the body of the cock-plug toward the body of the cock, and engages the inner wall thereof. The catch is preferably spring-actuated; and the parts are so arranged as to be readily put together, not liable to derangement, and positive in their action. When the cock is turned, the catch operates at the proper time; and the cock cannot therefore be turned until the catch has been disengaged, which cannot be done accidentally.

APPLICATIONS FOR LETTERS PATENT.

12,385.—Foulis, W., "Stirring and drawing the charges of gas and other retorts." July 4.

12,421.—Young, W., and Bell, A., "Decomposition of mineral oils for the production of illuminating gas." July 5.

12,441.—Lake, H. H., "Manufacture of gas." A communication from W. H. Harris. July 5.

12,504.—Siemens, F., "Regenerative gas-lamps." July 6.

12,664.—The Automatic Coal-Gas Retort Company, Limited, "Charging inclined gas-retorts." July 9.

12,696.—Johnston, J., "Gas-fires." July 11.

12,701.—Wright, F., "Dry gas-meters." July 11.

12,716.—Noteman, A., "Making heating and illuminating gas." July 11.

12,876.—Sugg, W. T., "Gas cooking-stoves." July 13.

12,887.—Thompson, W. P., "Liquid-meters." A communication from G. E. Samain. July 13.

12,924.—The Northern Counties Hydro-Oxygen Gas Company, Limited, and Goble, P. B. W., "Manufacturing oil gas." July 14.

13,035.—Haddan, R., "Measuring the density of gases." A communication from W. Durr and A. Custodis. July 15.

13,037.—Gow, J., and The Gas-Meter Company, Limited, "Coin-freed apparatus for the automatic sale and delivery of gas." July 15.

13,077.—Davy, D., "Gas-engines." July 16.

13,079.—Anderson, J., "Prepayment gas-meters." July 16.

Gas-Works Extensions at Elland.—The increasing demand for gas at Elland has rendered it necessary for the Gas Company to make some large extensions and improvements. In the retort-house, a stack of 70 retorts has been replaced by another of 64, by which the manufacturing capacity will be increased by 50 per cent. There are eight retorts in each bed; and these will be fired on Messrs. Jonas Drake and Son's gaseous generator principle. West's Gas Improvement Company are putting up some of their stoking machinery; and conveying plant is being constructed by Messrs. J. Buchanan and Son, of Liverpool. By this latter machinery, coal will be raised direct from barges on the Calder and Hebble Canal, and then conveyed to any part of the enlarged coal-stores. At a convenient point in the coal-store will be fixed one of West's breaking-machines; and from this the coal will be elevated into a 7-ton hopper in the roof of the retort-house. The alterations are expected to be completed by September.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Herring's "Gas-Works Construction."

Sir,—Mr. Herring is as disingenuous in his apology as in his offence; his letter being simply an attempt to place me in a false position. In my letter addressed to him, I did not (as he stated) say that there are other passages in his book closely resembling my writings. Imitation is admitted to be the sincerest form of flattery; and few would find fault on that score. What I said was that, in addition to the particular passage, three pages in length, unacknowledged, I found on a cursory examination of his book that other sentences of mine had been taken word for word, or with only here and there a word changed. I would be the last man to object to fairly-acknowledged quotation; but what I did, and do, complain of, is that passages of mine should be given by Mr. Herring as though they were his own.

Manchester, July 22, 1892. Thos. Newbigging.

The Question of Gasholder Guiding.

Sir,—I was glad to have my attention drawn to Mr. Livesey's letter in your issue of the 19th inst., and shall be very pleased to deal with the important points he has so courteously put forward. To this end, I will endeavour to prepare a few notes for the purpose, as the subject hardly lends itself to adequate treatment within the limits of an ordinary letter.

There are, however, one or two preliminary, though minor, matters which may at once be disposed of—more by way of explanation than otherwise. First, as to Mr. Walmisley's and my own papers read at the late meeting of The Gas Institute. So far as I am aware, there was nothing premeditated in the almost necessary juxtaposition of the two; and they were certainly not intended to have any reference to each other. So far as I have examined Mr. Walmisley's paper, it had reference solely to guide-framing, and the mathematical determination of the strengths of the various sections thereof; and I understood him to disclaim entering into the questions involved in dispensing therewith. With regard to my own paper, it contained no reference whatever to guide-framing, nor even to the bracing or strengthening of a gasholder or bell, but simply to the elementary direction, development, and relative values of the various resultant forces, within a cantilever plane, secured at two points, obtained from an initial horizontal force like the wind, together with proofs—which, by reduction to the most elemental conditions, I hoped would be appreciated by both mathematical and non-mathematical minds—that, theoretically, an equal distribution of the total load on a circular cantilever, secured at the base as described, will take place when those points are equi-distant. I presume it is the exceedingly elementary form of my paper which may prevent the necessity of further work on that head.

Second, I shall at once plead guilty to Mr. Livesey's kindly indictment that I did not deal with the question of the stresses on the side sheeting, whatever may be their nature. But I will ask that gentleman and your readers to consider that such omission was, under the circumstances pre-existing, by no means a remarkable one. When much appears left in doubt, it is a good maxim not to deal with too many things at a time, as I imagine Mr. Livesey has often had occasion to advise.

It must not be forgotten that the application of ordinary elementary mechanical truths to the study of this problem had been called into question, and strange and unrecognizable formulæ authoritatively laid down. Therefore it became absolutely necessary to clear the ground of a degree of peculiar fiction, and consequent prejudice in the minds of some, before any attempt to get "forrarder" could be of any practical utility.

The experiment described by Mr. Livesey is quite in accord with true theory regarding the forces requisite to open the cup joint on one side of an inner lift, as I hope to be able to show; and I am quite sure his conclusions, on that point at least, may be relied upon as true.

Manchester, July 22, 1892. W. Cadd.

The Cape Town and District Gas Company, Limited.

Sir,—In 1887 appeared the prospectus of the South African Gas Company, Limited (Cape Town Suburban Section). Amongst other brilliant prospects for the shareholders was the "assurance of such a quantity of gas being consumed, excluding public lighting, in the first twelve months of the Company's operations, as will secure, at 8s. per 1000 feet, a profit exceeding 5 per cent. upon the capital of £35,000" in Woodstock alone. The Engineer was Mr. E. Herbert Stevenson, Assoc.M.Inst.C.E., of 38, Parliament Street, S.W.; and the Secretary, Mr. J. A. Kelman. The ceremony of laying the foundation-stone took place in October, 1888; and the local papers duly chronicled the event of the promising undertaking possessing an official whose "ability and keen observation was sufficient that in four months the works will be in thorough working order." Mr. Arnott, in responding, guaranteed gas "of a very high illuminating power. One of its features would be its freedom from carbonic and sulphuric impurities; and he could guarantee that it would be perfectly healthy and superior to a London gas (*sic*)." In March, 1889, a contract was made with the Rondebosch Municipality, to commence in six months from date. These guarantees, prophecies, and contracts can now be valued. Rondebosch is lit with electricity; and it is not yet announced that gas-mains are within miles of the municipal district. Glowing accounts of progress appeared from time to time; and these panegyrics naturally excited expectations of brilliant results. The specified four months, however, passed, and many additional unspecified months, with no light for Woodstock; and the "model" works were still posing, and the existence of the South African Gas Company drawing to a close.

A prospectus in 1890 announced the formation of the Cape Town and District Gaslight and Coke Company, Limited; Consulting Engineers, Messrs. Stevenson and Burstal, MM.Inst.C.E.; Secretary, Mr. J. A. Kelman. Herein appears an extract from the report of the

Engineers (Mr. Stevenson visited Cape Town) upon the Cape Town Gaslight Company as follows: "The plant and buildings are in very good condition. The latter are constructed chiefly of stone, in a substantial manner; and the former has been mostly erected by well-known firms, and has been very carefully kept in repair, and not anything is required to be spent upon either works, apparatus, or mains to enable them to earn the same revenue in the future as in the past." And another upon the South African Gas Company of, I believe, a somewhat exceptional character.

These are the works described by the Chairman at the ordinary general meeting (see JOURNAL for July 5, p. 36) as being in such a state "that all profits for a time had ceased." The speech of Mr. Lass at the same meeting I cannot think is correctly reported, for the innuendo that the old Company were extravagant in the expenditure during the time it was being carried on in trust for the new Company, is unjustifiable. On the contrary, there would be some justification for the assertion that the only profit made was during that period. In the same number of the JOURNAL, there appears an extract from an article in the *Cape Argus* of the 1st of June. A complete reproduction would be interesting reading for technical men. Such a eulogy is understood by those possessing local knowledge. Is it not strange that in April, 1891, the "gas-works at Woodstock are as complete and compact as it is possible to make them," and the present condition of the Company is "a very melancholy one?"

The Chairman of the adjourned ordinary meeting asserted that the book-keeping of the old Company was practically *nil*. If so, how could Mr. Lass obtain the information for his report? And even if such were the case, what concern was it of the present Company's, and how could it affect their working, in whatever manner the old Company chose to keep, or not to keep, accounts? The prospectus states that Mr. Lass proceeded to Cape Town "with a view of reporting upon the present condition and future prospects of these undertakings." Perhaps, however, the Chairman, in his remarks, referred to the recent visit of Mr. Lass; and we may therefore infer that the directorate were so paternal as to send a gentleman of Mr. Lass's position to teach officials their work, who had been sent from England some considerable period in advance of their tutor.

It would appear that the loss by leakage when Messrs. Lass and Stevenson visited Cape Town was about 18 per cent. upon a quantity sold of (say) 26 million cubic feet. In 1891 the quantity was 35½ millions, and the loss (say) 14·5 per cent.; and yet it is asserted that the leakage has been reduced!

What a sequel to the prospective earnings, and vaunted wonderful working results—a gratuity of 4 per cent. to the shareholders, a production of 7578 cubic feet of gas per ton of coal, all profit ceased, a staff of 80 men.

Carmarthen, July 18, 1892. B. A. LEWIS.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, July 20.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* BOWEN *and* KAY.)

The Surbiton Improvement Commissioners v. The Governor and Company of the Chelsea Water-Works.

This was an appeal by the defendants from the judgment of the Divisional Court, given in the JOURNAL for May 3 last (p. 805), holding that the Company were liable for sewer-rate in respect of all their property within the limits of the Surbiton Improvement Act. The matter came before the Court on a special case, from which it appeared that the contention of the plaintiffs was that the defendants were liable to pay the rate for all their property in the plaintiffs' district, irrespective of part of such property being within the boundary of the Company's works; and that the fact of the property being enclosed within walls or fences belonging to the defendants did not exempt it from being rated. On the other hand, the defendants contended that they were not liable to pay the rate for any of their property comprised within the present boundary walls or fences, which were alleged to be "fence walls" within the meaning of section 24 of the Act, which provided that the Commissioners could not levy any sewer-rate on property of the defendants which for the time being should be comprised within the fence walls of the works of the Company, and in respect of any other of their property which, in the opinion of the Commissioners, might be sufficiently drained into any sewer and drain of the Company.

Mr. R. M. BRAY and Mr. BARTLEY DENNISS appeared for the appellants; Mr. MEADOWS WHITE, Q.C., and Mr. M. SMITH represented the respondents.

The MASTER of the ROLLS (without calling upon the respondents' Counsel) said: The only question raised upon the case is what is the true construction of section 24 of the Act with regard to the distinction between the property within and the property beyond the fence walls. There is a canon of construction, which, I think, is the right one—viz., that where language in an Act of Parliament, according to the ordinary reading (not the exact reading) of the English language, is capable of two constructions, and one of those will lead to a reasonable and businesslike conclusion, and the other to an unbusinesslike and unreasonable conclusion, the Court will adopt the one which leads to a businesslike and reasonable conclusion. That is the rule and canon of construction which Justice Day has applied to this Act of Parliament. He has done so in a lucid judgment; and I cannot add to, or diminish from, that which he has said. I think the judgment appealed from is absolutely right; and the appeal must therefore be dismissed.

Lords Justices BOWEN and KAY concurred.

Trade Items.—The Wenham Company, Limited, have been requested to carry out some extensive alterations and additions to the lighting of Sandringham House, for H.R.H. the Prince of Wales. Messrs. Parker and Lester are under engagement to supply the London County Council with Parker's imperial black varnish.

MISCELLANEOUS NEWS.

THE SOUTH METROPOLITAN GAS COMPANY AND THEIR WORKMEN.

Annual Meeting of Directors, Officers, and Men.

One of the recognized events of the year in connection with the South Metropolitan Gas Company is now the annual meeting of the Directors, Officers, and Workmen, which takes place in the cricket field and recreation ground at the Old Kent Road station. On these occasions, the men assemble in large numbers, and are in most cases accompanied by their wives and children; and everything and everybody bears a festive appearance. The third annual gathering was held last Saturday; and in every way it was as successful as the two preceding ones. There were upwards of 3000 persons present. The field was decked with flags, bunting, potted flowers, ferns, and palms; and the banks and temporary structures were studded with Chinese lanterns. The large platform from which the speeches were made was very prettily decorated; and at the sides were hung the framed illuminated addresses which were presented to the Chairman and Directors by the loyal and new hands in the spring of 1890, after the strike. The proceedings last Saturday were commenced by the performance of selections of music by the Old Kent Road Brass Band; and shortly after half-past three, Mr. GEORGE LIVESEY took the chair. He was supported by several of the Directors and officials; and Mrs. Livesey and other ladies graced the platform by their presence.

The CHAIRMAN, in his opening remarks, said he was very glad indeed to welcome the men again, on behalf of the Directors and the officers, to their annual meeting, to celebrate the profit-sharing scheme. Having apologized for the absence of three of the Directors—the Deputy-Chairman (Mr. John Mews), Mr. White, and Captain Heathorn—he reminded those present that these meetings originated by the spontaneous act of the workmen themselves, though he supposed that the profit-sharing scheme was the real cause of them. The idea they had in this scheme was, first of all, to attach the workmen to their employers. They were making a great experiment; and they wanted to bring capital and labour in a line. He was glad to see they had put up the motto over the platform, "Capital and Labour—United we stand; divided, we fall." The Directors were anxious to make the men feel that their interests were bound up with those of the Company. They recognized, too, the difficulty that a man had, who had a family and the expenses of a house, to provide for his old age. They were of opinion that, when a man had worked for (say) 40 years, he ought to have been able to save sufficient to live in comfort for the remainder of his days; and they thought the profit-sharing scheme would be a help in that direction. Only the other day one of the men informed him that, through this scheme and the Company's Building Society, he had become possessed of a house, and had paid a portion of the purchase-money; while previously he had never been in the habit of saving money. He was sorry last year that the Directors were compelled to raise the price of gas, and reduce the bonus from 5 per cent. to 3 per cent.; but he felt they had now touched the bottom. The Board had been enabled this year to make purchases of coal at a lower figure, and they would certainly not increase the price of gas again—in fact, the time was not far distant when he hoped they would reduce it. After having had five or six very bad half years, in the past six months they had nearly earned their dividend; and this half year, unless something unforeseen happened, he believed they would easily earn it, and then they would be thinking of reducing the price of gas, and increasing the bonus. A good many people had said that their scheme would soon come to an end; but his opinion was that it had come to stay. He was not going to say they had always succeeded—he was not going to say that in human things perfection was going to be attained; but he did claim this, that there had been an earnest desire in this scheme to do justice to everybody. This was the foundation of confidence; and he thought the present gathering proved very clearly there was a feeling of confidence between the workmen and the Company. When he thought of the distressing conflicts that were taking place, and the bitter feeling existing between workmen and their employers, he sometimes felt rather downhearted; but when he visited the works of the Company now, he was made happy by the pleasant greetings of the men. He went on to refer to the evidence he gave before the Labour Commission, which showed that, in the place of hostility and antagonism, they had peace and good will; in the place of mistrust, they had confidence; and in the place of sullen and discontented workmen, they had a body of cheerful, willing, and capable workers, with whom it was a pleasure to be associated. There were a good many people who would not give employers credit for kindly feeling, which, he was happy to say, many of them did possess. He remembered hearing Sir Henry Doulton say, on the occasion of a deputation to the Right Hon. W. H. Smith with regard to the question of finding work for men in London, that the most distressing part of his duties was to be compelled to refuse a man who applied to him for work. Commenting upon the statement of one of the witnesses who gave evidence before the Labour Commission, that his experience was that employers would not keep old men on their works, the Chairman said they had present their old friend Moss, who came into the works in 1838—54 years ago—and he could appeal to him to say that, during the whole of the time he had been there, when a man had become past work in the retort-house, if they had been able to find work for him elsewhere, they had always done so. He then dealt with the absurd contention of another witness, that capital should not receive any interest whatever; and proceeding he gave the result of an interesting calculation he had made. During the past ten years, he said, a good deal of money had been invested in the undertaking—a number of their workmen had invested money, and a considerable number of the consumers. He believed they had put £200,000 into the concern in the last two or three years; and that money was invested to pay 5 per cent. Each £100 returned about 5 or 5½ per cent. to the owner; and £100 he had found enabled the Company to pay £20 a year in wages. Speaking of the work in which they were engaged, he said that he wanted the whole of the men to feel they were partners in a very important public business, and that they had very

important duties and responsibilities resting upon them. He could prove that this was so. About two years ago, there was a threat of a strike of the stokers in the north of London. The Company placed the matter before the Government, who said that the supply of gas to London was of supreme importance, and under no consideration must it be interfered with; and they said they would supply any number of troops to march into the works to make gas. Of course, the Company would have offered them good pay, and the soldiers would have been allowed to volunteer to do the work. This showed that there must be no stoppage in the work. Supposing the Directors and officers of the Company, through some freak, said they would not trouble themselves any more about the concern, they would, he thought, come under the Conspiracy and Protection of Property Act, and would be committed to prison for three months, and they would well deserve it. (Laughter.) Alluding to the objection the Directors had to employ members of the Gas Workers' Union, he quoted the portion of the evidence given by Mr. Thorne, the Secretary, before the Labour Commission, in which he referred to the question of striking, and asserted that, if they had to fight the battle of the South Metropolitan Company again, they would not give seven days' notice, although he knew they would be breaking the law. There was another matter he wished to refer to. About a year ago one of the men at Greenwich was slandered; and he asked the Directors what they would do to protect him. They directed him to go to the Company's solicitors; and the result was an action for libel, in which they obtained a verdict of £200 and costs. The Company in this way spent upwards of £100 in defending the character of one of their workmen; and they would do it again—any fair, honest-minded workman should be defended against any unjust attack which should be made upon him. He had referred to the importance of the supply of gas to such a great city as London; but they were engaged in a greater work than that—the work of reconciling capital and labour. What they wished to do was to bring about industrial peace and concord; and the Directors wanted the men to feel that their own interests were bound up with theirs. They were trying to do this not only for themselves, but for their country. The eyes of all England had been directed to the South Metropolitan Gas Company; and they were anxious to show that it was possible for employed and employers to work well together. There was another subject he wished to refer to. Last Wednesday, the Directors resolved to adopt a plan of giving certificates to those workmen who showed special interest in developing the business of the Company. The Profit-Sharing Committee had drawn their attention to the fact that the workmen could very often suggest improvements in the working which would be of particular benefit to the Company; and they asked whether the Board would make any special recognition when such suggestions were made. The Directors readily assented to do this; and any man who could suggest an improvement which would be advantageous to the concern would now receive a monetary reward. They had adopted a system only a few weeks ago of giving a premium to every man who could bring in a new consumer, or who could introduce a customer for a new gas-stove. The certificates which they proposed giving they would have printed and put in a handsome frame. The form of the certificate was as follows:—

SOUTH METROPOLITAN GAS COMPANY.

This is to certify that the thanks of the Directors of the Company were given to Mr. , of the station; and this certificate was presented to him at the Annual Fête held on the day of , 189 in the Company's grounds, for promoting the interests of the Company, by

CHAIRMAN:

On this occasion he had pleasure in presenting to Mr. Frederick Packer a certificate for making an improvement in self-acting dampers for steam-boilers; to Mr. Manley, for a suggestion which facilitated the discharge of coke; and to Mr. Jesse Day, for proposing a method by which a saving would be effected in purchasing timber. Turning next to the profit-sharing accounts, the Chairman said that the bonus in the first year ending June 30, 1890, amounted to £6036, of which £3000 was withdrawn in the first month, and the remaining half was left in the hands of the Company. On June 30, 1891, the bonus was £8600, of which rather more than one-half was withdrawn in the first month. This year the bonus was not quite so great—£5700; and 1304 members out of 2235 had withdrawn the amount due to them. In conclusion, he begged them all to do what they could to carry out this great work of creating a bond of union between employers and employed, which would redound to the honour of Old England.

Mr. SIMPSON ROSTRON, in the course of a few remarks, said that one of the greatest questions affecting the future of the country was that of capital and labour. They were among the first who had attempted to do something in this direction; and they found it had been followed by many advantages. With regard to the price of gas, the Directors were determined to leave no stone unturned to hasten the day when they would be able to reduce it; and so increase the workmen's share in the prosperity of the Company.

Mr. EWART and Mr. ROBERT MORTON also spoke; and as this was the first occasion on which the latter gentleman had had the pleasure of meeting the men since they presented the Directors with albums two years ago, he took the opportunity of saying how much he valued the one he received.

Mr. FRANK LIVESEY was next called upon; and he spoke of the economy which could be effected by the men. Although they could not do much individually, they could, he said, do a great deal collectively to promote the interests of the Company.

Mr. BURROWS moved a hearty vote of thanks to the ladies and the Chairman, Directors, and Officers for their presence that day; and, on behalf of the men, he assured them of their gratitude for the very generous way in which they treated them.

Mr. DAVIS seconded the motion; and it was carried amid applause.

The services of the Secretary of the Profit-Sharing Committee (Mr. Sims) were also acknowledged; and this concluded the meeting.

Tea was then served to the numerous company, during which and afterwards the brass bands from the various stations played selections of music. At dusk, the grounds were illuminated; and later in the evening, a concert was given by the officers, workmen, and friends, being followed by a series of views, illustrated by a limelight optical lantern, exhibited by Mr. B. Waite and Mr. W. Elder.

EUROPEAN GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held on Monday of last week, at the London Offices, 11, Austin Friars, E.C.—Mr. M'LAUCHLAN BACKLER in the chair.

The SECRETARY (Mr. W. Williams) read the notice convening the meeting, and also the following report of the Directors:—

The Directors are gratified to report a steady progress in the Company's business, during the financial year ended on the 31st of March last.

The quantity of gas sold shows on the aggregate an increase of 3½ per cent.; but the actual amount of rental received is little more than during the corresponding period last year, owing to the reduction in price at Havre, and a falling off in the consumption at Boulogne. It is satisfactory to note that, in the former town, where the Company is subjected to severe competition from the electric light, the increase in the consumption of gas is greater than at any other of the Company's stations; so that it may reasonably be hoped that the amount of rental there will shortly show a corresponding improvement. At Boulogne, however, a similar competition, coupled with badness of trade, has had an unfavourable effect on the consumption of gas, with the result that, at one of the Company's stations, it shows a decrease compared with last year.

The average price of coke has been well maintained; but owing to milder weather, the sale has not been so great as in the previous year, and lower prices have now to be accepted, to prevent an undue accumulation of the stocks.

There has been a considerable decline in the value of both tar and ammoniacal products; but, the greater part having been sold under old contracts, these residuals do not show any material difference this year.

It was anticipated that the high price which had to be paid for coal during the period under review would unfavourably affect the amount of profits; and a reference to the accounts now laid before the shareholders will prove this to have been the case. But new contracts have recently been made at greatly reduced prices, and the Company's freight contracts have also been renewed on lower terms, as a consequence of which the cost of coals delivered at the Company's works next winter, will be but little higher than the cost previous to the great rise in prices.

Debentures to the amount of £10,100 were repaid during the year, and the balance of £8600 shown in the accounts was paid off on the 1st inst., so that the Company's debenture debt is now completely extinguished.

The concession for lighting St. Adresse—a fashionable suburb of Havre—has been prolonged until 1930. This, with the extensions mentioned in the last report, secures the Company's municipal contracts for lighting Havre and all its suburbs until the above date.

No outlay of importance has been incurred during the year.

Notwithstanding the enhanced cost of coals, and the reduction in the price of gas at Havre, the profits for the year admit of the payment of a dividend at the same rate as last year—viz., 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, which the Directors recommend be paid free of income-tax on the 30th inst., less the interim dividend of 8s. and 6s. per share respectively, paid on the 1st of February last. A balance of £428 will remain to be added to the reserve of undivided profits.

Notice has been given that two Directors (H. M'Lauchlan Backler, Esq., and E. T. E. Besley, Esq.) and both Auditors (F. J. Roan, Esq., and J. Reeson, Esq.) retire from office at this meeting. All, being eligible, offer themselves for re-election.

The CHAIRMAN said the report informed the shareholders that the past year had been one of unusual trial to the management of the Company. However, it was satisfactory to reflect that, notwithstanding, the Directors were able to recommend the ordinary dividend, and not only that, but also to add a small amount to the reserve of undivided profits, besides which they had invested nearly £25,000 in first-rate securities. They had paid off all the debentures by this time, which stood at £8600 when the accounts were made up; and this placed them in a very enviable position as regarded other companies who were in debt for loans and other means of raising money. There was no probability whatever of the Company having to issue fresh debentures. Should they acquire at any time another station, or require cash for any other purpose, they would have recourse to part of the large amount they had invested in securities. During the past year, they had been subjected to sharp competition from the electric light; but they had evidence that those who used the light had found out it was more costly than gas. Several of their old consumers had already left the light they had adopted, and were returning to gas; and this was especially the case during the winter months, for obvious reasons. They had been fortunate in their endeavours to increase the consumption of gas at the various stations—principally for cooking, heating, and motive power. The Board directed the energies of their Managers as much as possible to this important part of the business; and he was glad to say they were very successful, even in the use of gas for motive power. He might mention that, in connection with several of their stations, gas was the motive power used for dynamos. He hoped there would be a great deal of business done in this way, because it was advantageous to the Company, and it met the wants of those consumers who felt that—and this applied especially to tradesmen—they were paying more for electric light than they used to do for gas. They must have the electric light, but they did not want to establish a very costly installation; and therefore they were willing to use gas in many instances, and the Company were thus safe from the installation of a central station. He would be misleading the shareholders if he were to say they were able to supply gas in France on terms equal to those ruling in London; and one of the principal reasons was this: The custom in France was to grant concessions ("exclusive privileges" they were called) to gas companies for certain terms of years; and this was done with a *quid pro quo*—that was to say, the companies supplied gas for a certain number of years, and they had the exclusive privilege of laying mains for that period. On the termination of the concession, however, they had in most cases to give up the mains and part of the property without any indemnity whatever; and this was the reason why such long concessions were granted. The municipalities looked to the municipal budget; they found great difficulty in raising finances for their requirements; and they obtained money from every possible quarter. In regard to gas companies, they did this in various ways. In some cases they taxed the gas direct with a specified sum—this was one of the usual articles in treaties made at the present time. They also added to the municipal revenue anything else on which they could lay their hands. So that all this must eventually fall upon

the consumer, and tend to increase the price of gas. They had to succumb to this state of things; but certainly it was unfair. The worst part of it was the consumers grew discontented when they heard that London was supplied with gas at a very low price. They said: "How is it that this English Company, who ought to know how to produce gas on the same favourable conditions as their compatriots, do not supply it in France at the same price?" It was difficult to explain this; and the result was the consumers were too apt to blame the Company for the high (or comparatively high) price of gas, although the prices charged were not high when compared with other companies in France. Under those circumstances, it was satisfactory to the Directors to see there was an increase of 3¼ per cent. in the quantity of gas supplied by the Company during the year; and if the rental had not advanced in the same proportion, it was because there were certain reductions in the prices charged—there was that referred to at Havre, and at several stations there was a reduction all round, according to the consumption, but with no risk of bad debts. The Company found a compensation for this in the additional consumption, and also in the prolongation of the concessions. Having a long term added to a concession, enabled them to make arrangements for the writing off of the value of the mains, and of any other property which they had to relinquish, to be spread over a longer period. This was of great benefit to them; and they had many other little advantages in long concessions. A compensation was thus found in some measure for the conditions which were imposed upon the Company. The Chairman then proceeded to refer to the labour trouble which they experienced at Havre in the early part of the year, and which arose in this way: There was a strike of dockers; and they obtained what they wanted to a great extent in an increase of wages. They were reinstated in their employment; and other labourers in the town considered that, as wages had been raised in one case, they ought to be advanced in all others. So a great turmoil arose; the gas stokers especially being very clamorous. There was some justification, under the circumstances, for an increase in their wages. But these men were misled by others; and would not accept what was offered to them by the Directors, and went out on strike. Then another difficulty arose in carrying on the works, for the men left them on the shortest possible notice; and the Board were really in a very serious pass for some time. Had they granted what the stokers required, a series of strikes would have followed, which would have curtailed very considerably the reasonable profits which the proprietors derived from the undertaking. The men were out for ten days; and they thought that, by adopting the usual means of intimidation, they would prevent the Company carrying on the business. But the Directors succeeded in getting other men in from day to day; and they also obtained the good-will of the mechanics and others in the employ of the Company. The works were kept going with great difficulty, because these men were not experienced; and they had to be taught the very first principles of stoking before they could be of any use whatever. When the strikers found they could not prevent the carrying on of the works, well or ill, they came round humbly enough, and asked to be reinstated on the Company's own terms; and the Directors allowed them to go in, not having any experienced hands to replace them, although they could have gone on without them for some considerable time in the summer months. It was very satisfactory to the Board to have such an exhibition of good will on the part of the mechanics and others. The expenses were, of course, considerable; for the measures the Board had to take were unusual, and they had to be adopted in an emergency. The wages now were also higher, owing to the amount which they considered it right to grant the stokers who did their duty properly. He could not leave this subject without saying—and he did so with the greatest pleasure—how much the Company were indebted to many members of the staff for the way in which this very difficult matter was carried through; and he mentioned more especially the Secretary (Mr. Williams), who went over to Havre at a moment's notice, and, with the Manager, conducted the whole of this troublesome business. During the last two months, he (the Chairman) had visited the whole of the stations of the Company, accompanied by one of his colleagues (Mr. Besley), who was very satisfied with all he saw. For himself, he could say that he was extremely pleased with the condition of things at the works. He was not able to visit them so frequently as in former years; but nothing had suffered in consequence of this. There was a constant inspection of the stations by the different members of the staff; the accounts were thoroughly investigated by the Accountants; and the Directors received information, he might say, daily regarding the working. Referring next to the strike of the Durham miners, he remarked that the Board had no reason to suppose it would have been of such long duration; but, like prudent men, they had procured sufficient stocks forward to last for a long time. It was only towards the end of the strike that it became necessary to make further provision in French and other descriptions of English coals, which were not of such good quality as the Durham coals for gas making, but for which they had to pay, for the time being, a heavier price. Recapitulating the principal points which struck him as being against, and in favour of, the Company, the Chairman said they had the electric light against them, and he was told they had also petroleum; but, considering all the inconveniences of the latter, it was not a thing which need alarm them—it was really *une quantité négligeable* at the present time, at all events. There was the labour question, which might meet them again from time to time, although, having got the better of it in this instance, he thought it would be much more difficult for the men to attack them again with any chance of success. Then there were the residual products, which did not at the present time, and would not, he believed for some time to come, yield the price which was formerly obtained for them. On the other hand, they had the certainty of a much cheaper supply of coal for two years forward, under contracts made just before the Durham strike; and he was told it would be difficult to obtain coal on the same terms at the present time. Then the consumption of gas was increasing, not only for cooking, heating, and motive power, but also for lighting. Whether it would continue to increase for lighting was rather doubtful. Turning to the financial position of the Company, the Chairman pointed out that the investments stood at the considerable sum of £153,000; £25,000 having been added this year. The depreciation and redemption account they took from profits, to provide for the loss of property at the end of the concessions, unless, of course, they were renewed again and again. Then they had paid off all the debentures, which, as he had stated in his opening remarks, was a course which very few Companies had been in a position to adopt. In conclusion, he moved the adoption of the report and accounts.

Mr. E. F. WHITE seconded the motion.

Mr. COPPEN, having expressed the hope that the Chairman would long be spared to conduct the business of the Company, asked for an explanation regarding the Boulogne station, from which they derived a very small return for the money invested.

The CHAIRMAN said that it was true that they had constructed larger works at Boulogne than were required. At that time they anticipated there would be a great extension on account of the harbour which was expected to be laid out there. But money was scarce; the works were interrupted; and the extension did not take place; and so perhaps they were over-prudent in preparing themselves for the future. He should also explain that, before striking a profit, interest at the rate of 4 per cent. on the capital was charged against all the stations; and this was brought back again and appeared as interest at the foot of the accounts *en bloc*.

On the motion of the CHAIRMAN, seconded by Mr. N. E. B. GAREY, the dividend recommended in the report was declared.

Mr. GILL then proposed, and Mr. GAREY seconded, the re-election of the retiring Directors (the Chairman and Mr. E. T. E. Besley); and this was agreed to.

The CHAIRMAN and Mr. BESLEY acknowledged the continued confidence of the shareholders; and the last-named gentleman also made a few remarks regarding his visit to the Company's stations. This, he said, was highly satisfactory in these respects: First, everything appeared to be in good order; and, second, the managers and the workmen seemed to be on the best of terms. After an absence of some years from Havre and Boulogne, it was astonishing to him to see how building had developed in those two centres of population; and he had the greatest possible hope that, although the increase in the Company's business was small, it would be progressive for many years to come. There was one very important thing in connection with their Company. In these days it was the fashion to have debenture and preference capital before the ordinary. Was it not, then, a happy thing for them that every penny which they now earned would be for the benefit of the ordinary shareholders? They ought really to be called "extraordinary" shareholders.

The Auditors having been re-appointed, the services of the Chairman and Directors and the officials were fitly recognized; and the proceedings then terminated.

GALASHIELS GAS COMPANY.

By way of supplementing the particulars lately given by our Scotch Correspondent as to the working of various gas undertakings coming within his purview, we extract a few figures from the report presented by the Directors of the above Company—the principal one in the South of Scotland—at their recent annual meeting. The profit for the past financial year was £1934, which, added to the balance brought forward of £5695, made a total of £7629. This the Directors recommended should be appropriated as follows: Dividend to the shareholders (10 per cent., free of income-tax), £2100; to be carried forward, £5529. The gas manufactured during the year was 61,517,000 cubic feet; the loss by leakage, 1,763,422 cubic feet; and used in works and offices, 500,000 cubic feet. The quantity of gas passed through the consumers' meters for the year was 59,253,578 cubic feet; for the year 1890-91 it was 55,591,156 cubic feet—being an increase of 3,662,422 cubic feet. The illuminating power was kept up during the year at the usual high standard of 29 candles. In consequence of the rise in the price of coal, and the heavy fall in the value of residual products, the Directors have been obliged to increase the price of gas for the year 1892-3 to 3s. 9d. per 1000 cubic feet. The Chairman (Mr. Sanderson), in moving the adoption of the report, remarked that the increase in price was necessitated by the great diminution in the value of the residual products, and the advance in the cost of coal. In 1864 the Company made 10,249,000 cubic feet of gas, which was sold at 5s. 10d. per 1000 cubic feet; and the average cost of the coal from which it was produced was £1 0s. 3d. per ton. The number of consumers then was 1426. The gas sold in the twelve months ending May last amounted to 59,253,578 cubic feet; the price was 3s. 6½d. per 1000 cubic feet; and the consumers numbered 4150. The average price of coal, however, was £1 2s. 4½d. per ton. For tar and other residual products they received during the past year £611, whereas in the previous year they had £1519—a net loss this year of £908. Therefore it was necessary to put up the price of the gas, as mentioned in the report, to 3s. 9d. per 1000 cubic feet. He had further to say that the Directors had expended upwards of £5000 in the way of improvements to the works within the past three years. In conclusion, the Chairman referred to the relative cost of gas and electric lighting, and to the use of the former for other than illuminating purposes. In the latter connection, he stated that last month the Company supplied 330,000 cubic feet more gas for cooking and heating than they had done in the corresponding month of the previous year. The motion was unanimously adopted.

The Wolverhampton Corporation and the Electric Light.—The Wolverhampton Town Council discussed in committee last Wednesday the question as to the advisability of supplying the borough with the electric light. A long report was presented, giving a mass of figures relating to the subject, together with the opinions of two electricians as to the probable cost. According to the scheme discussed, it is only proposed to light a small area in the centre of the town. The Council were unanimously in favour of adopting the scheme; and it was ultimately resolved to apply for the necessary Provisional Order.

NEWBURY CORPORATION GAS SUPPLY.

Proposed Extension of the Works.

At the Meeting of the Newbury Town Council on Monday last week—the MAYOR (Mr. A. Jackson) in the chair—the question of the proposed extension of the gas-works gave rise to a long and, at times, acrimonious discussion.

The matter came up on a report made by Mr. W. A. Valon, Assoc. M.Inst.C.E., who had been called in to inspect the works. This he did on the 2nd inst.; and subsequently submitted the following recommendations: With regard to the retort-house, he advised the duplication of the present building, and making provision for six additional beds holding the same number of retorts, but about 18 inches longer, so as to have the full benefit of the fire. By the introduction of gaseous firing, the new house would, he said, produce 7300 cubic feet of gas per mouthpiece, instead of 4300 cubic feet as at present, or a maximum for the whole of the proposed beds of (say) 235,000 cubic feet per day. As to storeage, he recommended the present capacity should be increased from 127,000 to 200,000 cubic feet, which would be sufficient for the next five or six years. He thought that the scrubber should be heightened; and that duplicate boilers should be provided. Generally, he did not find anything radically wrong in the works and plant. In some cases they needed a little re-arrangement; in others, some extension. No time should be lost in preparing for the new retort-house; and the large holder might, he said, be handed over to the contractor at the beginning of May next year, with the stipulation that it should be ready for use again at the end of July. Though £10,000 would be sufficient to carry on the works for the next 12 or 14 years, he recommended, as a safe margin, that it should be increased to £12,500. The capital expenditure would run something as follows: Coal-stores, retort-house, and scrubber, two new boilers, &c., £3000; gasholder and tank, £4000; working capital, £2500; contingencies and capital for the extension of mains, purifiers, &c., £1000—total £10,500. The report concluded thus: "I would say that I have carefully examined the figures contained in the balance-sheets, working statements, &c., forwarded to me by the Town Clerk, and Messrs. Alfred Lass, Wood, and Co.; and I may remark they are beautifully and clearly kept. By these I find that the principal part of the capital now expended took place soon after the Corporation obtained possession of the works; and at this distance of time, and from the fact of my having no knowledge of your works at that period, it is impossible for me to say if the whole of this money was judiciously expended. Speaking from observation, however, I should say that the capital was extravagantly handled, and that more should have been done for the amount spent. I can say that your works are fairly designed, and the arrangement of plant fairly good; and if in the future capital expenditure is carefully incurred, there is no reason why the amount expended per ton of coal carbonized should not be greatly reduced from year to year. The working statements show the quantity of gas made per ton of coal to be satisfactory; and the yield of tar is good. The make of sulphate should be larger; but this I understand is accounted for by the new works not having been in operation during the whole year. The fuel used, owing to the system of heating the retorts by direct firing, is about the same as would obtain in any other works under similar conditions. I may safely predict, however, that by the introduction of gaseous firing in your new retort-house, and the use of large boilers, there will be a beneficial effect on this item of expenditure. My thanks are due to your Manager, Mr. R. M. Couper, for the clear way in which he has explained everything to me, and also for the trouble he has taken to furnish me with immediate answers to any queries I have thought it desirable to put."

Mr. LUCAS moved the adoption of a resolution agreed to by the Gas Committee at their meeting on the 15th inst., to the effect that, having considered Mr. Valon's report, they regarded it as satisfactory, and recommended the Council to acquire power to borrow £10,000 for carrying out the improvements suggested therein. In doing so, he expressed regret at the absence, owing to a bereavement, of Alderman Jackson; but that gentleman had, he said, had the opportunity of submitting all his objections to Mr. Valon. It would be recollected that it had been arranged that the Mayor and himself should meet Mr. Valon; but Alderman Jackson was present, and heard the whole of what took place. Since then he (Mr. Lucas) had had no communication verbally or otherwise with Mr. Valon.

Alderman ADEY asked why some members were summoned to meet at 9.30, and others at 11?

Mr. LUCAS explained that the Gas Committee were summoned to meet after Mr. Valon's inspection of the works; but he knew of nobody being asked to come at 9.30, except Alderman Jackson and Mr. Elliott, to give them an opportunity of meeting Mr. Valon while he was in Newbury.

Then ensued an angry altercation between Mr. Lucas and Mr. Elliott as to whether the latter was or was not invited to be present to meet Mr. Valon. In the course of it, Mr. Elliott accused Mr. Lucas of stating what he knew to be untrue. At the close of this episode,

Mr. LUCAS proceeded to deal with Mr. Valon's report. Alderman Jackson's objections he said, went back to the time when the works were taken over by the Corporation; and it was obvious that he was hopelessly wrong from beginning to end. The point of the whole controversy had been that the capital was over-spent; and Mr. Valon's report confirmed this. Alderman Jackson had complained of the large amount laid out in maintenance of works; but he found that, in the last account prepared under the chairmanship of that gentleman, the expense for maintenance and repairs was in excess of anything which had been charged in any year since. Mr. Valon recommended the borrowing of £12,500; but the Committee thought it better to confine themselves to £10,000, as it might be possible to save money from profits, which could be utilized. An extension must be made, and £3000 spent immediately, or they would break down during the winter of 1893. Therefore they ought to obtain their powers for borrowing, and put the work in hand. There was no intention to lay out all the £10,000 now; and no portion of it could be spent without coming to the Council and having an inquiry.

Mr. RAVENOR seconded the motion.

Alderman ABSALOM thought that, instead of telescoping the present holder, they should have a new one.

Mr. ELLIOTT then proceeded to explain the hostile position he had taken up. Referring to the statement by Mr. Lucas that both he (Mr. Elliott) and Alderman Jackson might, if they had wished, have met Mr. Valon, he (the speaker) said he certainly did not go, and he persuaded Alderman Jackson not to do so under such conditions, as his appearance would only give Mr. Lucas an excuse for saying that a fair inquiry had been held. However, Alderman Jackson took his own course; and if present, he would have been able to state what chance there was, under such circumstances, a giving a fair consideration to financial matters. But it was said Mr. Valon had the balance-sheets put before him, and had reported that, they were "beautifully and clearly kept." He had himself, on more than one occasion, spoken of how thoroughly Messrs. Alfred Lass and Co. made up their working statements; and his complaint was that the Council had refused to listen to these reports, which time after time, in as plain language as officials could use, had drawn attention to the mismanagement. Mr. Valon, moreover, said that the capital at the beginning was "extravagantly handled." This, he believed, was admitted; but that horse had been ridden to death during the past ten years. The report spoke of the works being, as a whole, fairly designed; and this was followed by a statement that the make of gas per ton of coal was satisfactory. No one had ever denied that. However, the contention had all along been that the works had been extravagantly managed. The concern was taken over with part of the original capital unexpended and a reserve of £400; and now, after ten years of most successful business, they were landed in a deficiency of £2600.

Mr. LUCAS remarked that the balances were "paper" ones.

Mr. ELLIOTT said how, then, were the Council to know that the statements now made were not equally unreliable. The fact was that Mr. Lucas would say anything, whether true or untrue, if he could thereby gain his ends.

Here ensued a "scene;" Mr. Elliott persistently refusing to comply with the demands for a withdrawal of this charge. A motion was eventually submitted, and carried, that Mr. Elliott be not heard until after he had withdrawn his reflection on Mr. Lucas. Mr. Elliott protested that, in a matter of £12,000 expenditure, he impugned the conduct of the Manager of the works and the Chairman of the Gas Committee. Something like tranquillity having been restored,

Mr. HALL continued the discussion. He said he asked Mr. Valon if there had been any extravagance in the management, and whether there was anything that reflected discredit upon the present Chairman; and he said distinctly there was nothing that he could pick out, and that it was the original construction of the works which prevented so much gas being made as would otherwise be the case. It was well known that the mischief was done before Mr. Lucas took over the chairmanship; and he was entirely exonerated from the charge of mismanagement made by Mr. Elliott.

Mr. ELLIOTT: If you allow this, I shall reply in spite of everybody. I say, whatever you asked Mr. Valon you had no right to do so.

Mr. RAVENOR supported the borrowing of £10,000, as it was not to be spent until required.

Some further remarks having been made,

Mr. LUCAS replied generally on the discussion, and answered special questions put to him.

The motion was then put, and carried by seven votes to four.

After the excitement of the meeting had passed away, Mr. Elliott evidently regretted his conduct towards Mr. Lucas; for on Wednesday he addressed a letter to the local paper expressing his sorrow that he did not withdraw the assertion made with regard to him. He added: "However much justification I may consider I had for making it, I feel it ought not to have been said; and I will not let my pride hinder my acting fairly to an opponent."

THE DOVER TOWN COUNCIL AND ELECTRIC LIGHTING.

At the Meeting of the Dover Town Council on the 12th inst., the members had under discussion a long communication from the Brush Electrical Engineering Company, Limited, on the subject of the agreement to be entered into between the two bodies for carrying out an electric lighting scheme in the town. The deed of transfer as amended by the Electric Lighting Committee of the Corporation, had been considered by the Company, and agreed to in principle, subject to certain points reserved. The Company urged the Council to accept their suggestion that the Dover undertaking should be merged into a single concern with the undertaking at Canterbury, where the Council had agreed to the transfer of their Provisional Order to the Company, including the suggestion of amalgamation with Dover. The only object in pressing for this was that, by concentration under one Board, and having a single organization, the working expenses of both undertakings would be very largely reduced; thus enabling the local Company to work at a profit upon a smaller charge for electricity supplied to consumers than could otherwise be the case. The Company said they could not accept the amendments suggested by the Committee in the clause relating to the annual accounts, which it was suggested should be debited with a sum of not more than 2½ per cent. to cover depreciation; a further proposition being put forward that there should be a compulsory reduction in the price of the current after a profit of 10 per cent. had been realized in any one year. The Company thought 7½ per cent.—the usual figure,—should be allowed for depreciation; and, with reference to the compulsory reduction in price, they suggested the adoption of the terms agreed upon between the Company and the Corporation of London—viz., that when in any year the balance of receipts over expenditure exceeded a cumulative profit of 10 per cent. per annum on the amount of the capital, the price should be reduced ¼d. per unit for each 1 per cent. over 10 per cent. shown in the accounts. The next point was as to the supply of current to the public lamps; and the Company stated that they could not accept a figure so unduly high as 20s. as the maximum penalty per

arc lamp per night which the Committee thought should be imposed for any failure of the light. The Company again brought forward their agreement with the City of London in this respect—viz., a penalty of 1d. per minute per lamp, with a maximum penalty of 5s. per lamp per night—and expressed their willingness to accept this. They stipulated, however, that no penalty was to be incurred for failure within 15 minutes of the time at which the lighting ought properly to commence. In the discussion which took place, it was agreed to change the name of the Company to the Dover and Canterbury Electric Light Company, on condition that the accounts of the two undertakings should be kept separate, and that the chief offices should be at Dover. The question of the amount of depreciation was also disposed of—the Company's proposal of 7½ per cent. being accepted. On the subject of the price and dividend, Alderman Fry said he thought 7½ per cent. should be the figure, with a reduction in the charge when this was paid. Alderman Adcock moved that the Company's proposal be agreed to. Mr. G. Mowll remarked that they were going to put up 21 electric lamps, for which they would pay £650 per annum. However, he wished to see the electric light in the town; and he should support the motion. Mr. Clark said the outlay would mean a rate of 1¾d. in the pound; but from this would have to be deducted the cost of the disused gas over the area selected. The Mayor (Sir W. H. Crundall) remarked that the expense would be 50 per cent. more than that of gas; but about eight or nine times as much light would be afforded. The motion was carried; and the remaining clauses in the agreement were then disposed of.

Bradford Corporation Water Supply and Lead-Poisoning.—The Medical Officer of Health (Dr. Aston) reported, at the meeting of the Eccleshill Local Board last Tuesday, that the Bradford Corporation had devised special methods for altering the character of the water supplied in the district, so as to make it no longer plumbo-solvent.

Shipley Gaslight Company.—The annual report and balance-sheet submitted at the meeting of this Company last Wednesday showed that the income had amounted to £22,336, of which £17,379 was for sale of gas and lighting of public streets, and £4405 for residual products. The total expenditure had amounted to £16,516, of which £13,274 was for the manufacture of gas; £790 for distribution; and £1364 for management—a balance of £5820 being left for the payment of dividends and other purposes. The report and balance-sheet were adopted; and dividends were declared at the rate of 10 per cent. per annum on the original stock, and 7 per cent. per annum on the new ordinary stock.

Colne Valley Water Company.—The Directors of this Company, in the report to be presented to the shareholders at their half-yearly general meeting on the 2nd prox., state that the net profit for the six months ending June 30 last was £3755, or £475 more than in the corresponding period of 1891, and this after an additional payment of £250 for Directors' fees. The dividend and interest account accompanying the report shows a balance of £2288; after paying the usual 4 per cent. interest on the debenture stock and preference shares, and transferring a further £250 to the old engines suspense account, and £100 to the reserve account. Out of the balance, the Directors recommend a dividend at the rate of 3 per cent. per annum; leaving £384 to be carried forward.

Water-Works for Bamborough.—On behalf of the Local Government Board, Colonel J. O. Hasted, R.E., held an inquiry at Bamborough last Thursday, with respect to the proposal of the Doncaster Union Rural Sanitary Authority to borrow £1500 for works of water supply for the parish. Mr. G. White, C.E., of Mexborough, who had prepared the plans for the works, stated that water was very plentiful in the neighbourhood; and he proposed to collect it in a reservoir capable of containing 42,750 gallons. The Rev. G. Cole, the rector, said the parishioners did not expect more than £700 would be needed to be borrowed; and they were surprised at £1500 being asked for. The Inspector promised to lay the representations before the Local Government Board.

The Electric Lighting Installation for Dublin.—According to the terms of the contract, the electric lighting works for Dublin should have been completed in May last; but the light has not yet made its appearance. This has caused much dissatisfaction; and inquiries which have been made into the matter have elicited "explanations which," says the *Freeman's Journal*, "to say the least of them, are slightly contradictory of each other." From these it would appear that two of the engines were only delivered last week; and this has retarded the completion of the works. Temporary ones were fixed, in the hope that the lighting would take place (as was expected) during the Trinity College tercentenary celebration. However, owing, it is stated, to some other portion of the works not being sufficiently well advanced, the project had to be abandoned. It is anticipated that a commencement will now be made with both public and private lighting on Aug. 1.

Fatal Accident at a Gas-Works.—A dreadful accident occurred last Thursday afternoon at the Bollington (near Macclesfield) Gas-Works, resulting in the death of three men by suffocation. A labourer, named George Fairbrother, was engaged in steaming some pipes underground with ammonia when he was overcome by the fumes. A man named John Morrell immediately went to his assistance; but he also was overpowered. A stoker, named Snape, then endeavoured to rescue the two; but he unfortunately was likewise rendered insensible. A Mr. Mellor, who happened to be on the spot, together with Mr. Froggatt, the Manager of the works, next attempted a rescue; and they too were immediately overpowered. The cries for help raised by a young fellow named Knight then attracted the notice of several other men, who managed to get the five unconscious men out, although they, too, had a narrow escape from suffocation. Froggatt and Mellor were found to be alive; but the other three—Fairbrother (who had been employed at the works for the last 20 years), Snape, and Morrell—were dead, the bodies being quite black. The steaming of the pipes is performed periodically; and no accident of a similar kind has previously taken place. An inquiry into the circumstances was opened at the gas-works on the following day, by the Coroner (Mr. H. C. Yates); but, owing to the serious condition of Mr. Froggatt, it was adjourned till next Friday.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Wednesday, July 20.

(*Lord* Balfour of Burleigh, *Chairman*; *Sir* G. B. Bruce, *Sir* A. Geikie, F.R.S., *Professor* Dewar, F.R.S., *Mr.* G. H. Hill, M.Inst.C.E., *Mr.* J. Mansergh, M.Inst.C.E., *and Dr.* W. Ogle, *Commissioners.*)

On the resumption of the proceedings to-day, after the adjournment on the 28th ult. (*ante*, p. 79), several witnesses were recalled to correct and elucidate a few of their statements put on record; and, there having been a difficulty in arranging for the appearance of others on this occasion, there was no further testimony.

Mr. *J. Searle*, the Clerk of the New River Company, in response to a previous request from Mr. Mansergh, handed in a table giving the number of supplies provided by his Company in eight different periods of five years—those from 1851 to 1891.

Sir G. B. Bruce observed that there was an increase of 75 per cent. in 40 years.

Witness said this was so.

Mr. *J. Francis*, Engineer of the Company, submitted detailed information in writing concerning the gaugings of the Chadwell spring. He also made reference to the minutes of the evidence given before the Royal Commission on Water Supply in 1867—pointing out that it was stated therein that the average flow at the Chadwell spring, during a number of years, was 400 cubic feet per minute, or 3,600,000 gallons per day; but that sometimes the flow was very much more, and that the average of one year was 500 cubic feet per minute, or 4,500,000 gallons per day. Throughout 1889 the daily average reached only 2,500,000 gallons; and, in the autumn months of that year—August to December—it fell to, in some cases, in certain weeks, as low as 720,000 gallons, and never rose, except in one week, above 3,000,000 gallons. That year, there was a dry winter; and the result was a comparatively low yield.

The Chairman: Then your experience is that the Chadwell spring answers somewhat quickly to a period of drought?

Witness: Yes, it does; and, were we now to have a series of wet years, we should get 4,500,000 gallons, I have no doubt, as the average for the year.

But does not that raise the assumption in your mind that, as a permanent source of supply, that spring is not very much more reliable than the flow of an ordinary stream?—Yes; and giving in the return what amount of water we can now rely upon, I have put the spring at a very low figure indeed. The lowest has been about 750,000 gallons.

I might take it, then, that what you could rely upon, under the most adverse circumstances, would be something under a million gallons a day from that source?—Yes; that is what we reckon.

In the autumn of 1891, the flow for some weeks fell to 450,000 gallons a day?—That was exceptionally low.

Are there any circumstances within your knowledge which would account for that lowness?—No; I cannot say I can point to any special reason, other than the general dryness of the season.

Was the autumn of last year so very dry?—The only months in which we had much rain were July, August, and October.

If you had an exceptional amount in July and August, that would hardly explain the spring going so low in September, would it?—The October rain told; but the July and August rains did not. Before they came, the ground was so dry that they did not reach the spring.

Mr. Hill: At many times of the year you might have very heavy rainfalls, and yet the spring would not be affected?

Witness: Yes; that is so. In the very dry months, a heavy rainfall does not assist us. It is when the rain comes in the winter, when the ground is saturated, that we get the full benefit of the showers.

The Chairman reminded the witness that, when he was previously before the Commission, the question of the population above the intake of his Company was raised, but he had not the figures then; and, since that time, a table on the subject had been furnished.

Witness pointed out that the table alluded to gave the population of the whole of the watershed of the River Lea and its tributaries above his Company's intake, and other information of a cognate kind.

And the effect of this is that the table goes to show that the urban population is increasing more rapidly relatively than the rural population?—Yes.

Witness also submitted a statement respecting the flow of the Lea, and the quantity of water taken from it by his Company, and corrected an obvious misstatement about the former.

Mr. *E. Collins*, Superintendent of the distribution works of the New River Company, was the next witness recalled. He put in a table giving estimates of the quantities of water supplied by the Company for trade, domestic, and other purposes.

Mr. *W. B. Bryan*, Engineer, and Mr. *I. A. Crookenden*, Secretary of the East London Water Company, next came forward, and explained away some discrepancies in the statements made on behalf of their Company.

Mr. *J. W. Restler*, Engineer of the Southwark and Vauxhall Water Company, presented a table showing the results of testing the quality of the water which the Company obtained from the gravel beds, from what they called natural filtration beds near the Thames; and the general effect, he explained, was to substantiate the statement made, that there was little or no practical difference between the filtered Thames water as supplied and the natural filtration water.

Professor Dewar: And the inference you drew from this was that natural filtration water was quite as good as the filtered Thames water?

Witness: And sometimes, no doubt, better.

And the natural filtration, is it as rapid now? Are you collecting quite as much now as then?—Not quite so much.

How do you account for that? Is it necessary to reconstruct in any way the natural filtration?—I do not think it is yet; but in course of years it will be.

At the present moment the rate is not materially diminished?—I think it has fallen rather less than 1,000,000 gallons.

What percentage of the original?—Something like 10 per cent.

That refers to the whole area of the natural filtration beds?—Yes.

In reply to the CHAIRMAN, the witness stated that the maximum quantity of water supplied by his Company per day in seven days was in the week ending Sept. 12, 1891, and was 29,224,111 gallons, according to what ought to be done by the working of the engines and pumps. If they deducted 10 per cent. for slips and short strokes, the actual quantity would be 26,301,700 gallons.

Is this deduction a difference from, or in conformity with, the return made to the Official Water Examiner?—The return made to the Water Examiner was the higher figure.

Then the greatest quantity per day for any continuous month was in September, 1891, and was 28,303,834 gallons; and with the same deduction, it would be 25,473,451 gallons?—Yes.

And, as a matter of course, the higher figure would be the one that would be returned to the Water Examiner?—Yes.

And the maximum quantity for any day in any period of three months was in the three months ending October, 1891, and was 27,669,698 gallons?—Yes.

Less the deduction of 10 per cent., the actual quantity would be 24,902,729 gallons?—Yes.

Mr. *A. Dickson*, the Secretary of the Kent Water Company, put in some additional calculations with respect to population; proving the accuracy of the Company's estimate already handed in. Dr. Ogle had, he said, asked him to furnish a few examples of parishes within and beyond the Metropolitan area, to show, as nearly as possible, that the Company's mode of approximating population was fairly accurate; and he undertook to get out the numbers of the total supplies in the parishes selected—comparing these figures with the populations there. He took Greenwich, Plumstead, and Bromley; and he found that, on the 1st of April last year, the Company had in Greenwich 9122 houses entered in their books as being connected with their mains. There were also 249 other supplies—making a total of 9371 supplies in the parish; and the Company's estimate of the population, reckoning six persons per supply, was therefore 56,226. The census population of the parish on the 1st of April, 1891, as given in the preliminary report, was 57,244. The difference between the two figures was only 1000. Witness also submitted a table supporting his previously expressed opinion that the constant supply, with proper supervision, was the most economical system.

In reply to Dr. OGLE, witness explained that during a frost the quantity of water supplied by the Kent Company was much greater than at other times, because the practice of householders was to keep their water-taps open, and let the water run continuously to prevent freezing of the pipes, with probable bursting.

Mr. *W. Morris*, Engineer of the Company, submitted a map showing the position of their wells, and the stratification at each of them. In compliance with a request of the CHAIRMAN, he presented a table showing the highest daily averages of the Company's supply from wells, in periods of three, six, and twelve months. In the quarter ending July 9, 1892, the highest average was 14,213,000 gallons; in the half year ending June 30, 1892, it was 13,772,000 gallons; and in the twelve months ending Dec. 31, 1891, it was 13,535,000 gallons. These averages were, he said, continuously increasing.

The CHAIRMAN: And when the tables are examined carefully, will they show that the water in the wells stands in any case materially lower after a long spell of pumping?

Witness: I do not think so. I do not believe there is much variation. But, of course, something depends upon the rainfall.

Mr. *A. Fraser*, the Engineer of the Grand Junction Water Company, was the last witness recalled. He put in a tabular statement as to the quantities of water supplied by his Company to clubs—showing 7000 gallons per day on the average for these institutions. He added that this supply was by meter; the members of the clubs preferring this system—believing that by it they obtained the water cheaper.

There being no other witness in attendance, the Commission adjourned till the following day.

Thursday, July 21.

Mr. *H. Yool*, J.P., Chairman of the Sanitary Committee appointed by the Surrey County Council, and for many years Deputy-Chairman of Quarter Sessions for the county, was the first witness to-day.

The CHAIRMAN said the witness had been good enough to submit a statement in regard to matters which the Commission was appointed to inquire into; but there were in it some points which, having been discussed, were not, in their opinion, within the scope of their reference. He did not, therefore, propose to examine the witness thereon. In the first paragraph of the statement, a list was given of the authorities which had powers, duties, and obligations in reference to the pollution of the River Thames and its tributaries.

Witness said that was so. The Surrey County Council had appointed the Sanitary Committee to assist them in dealing with the pollution of rivers, and with questions concerning the public health; and they had obtained the services of Dr. E. Seaton, as the Medical Officer of Health for the county. The tributaries of the Thames which either passed through or bounded the county of Surrey were the Wey, the Wandle, and the Mole; but, up to the present time, attention had been principally given to the Wey and the Wandle. Asked what had been the character of the reports made about the Wey by Dr. Seaton, witness replied that its condition was most unsatisfactory. It was greatly polluted by sewage, especially from the boroughs of Godalming and Guildford, and by polluting matter from the tanneries and paper-mills. The mills were a great trouble. The quantity of effluent was large, and they had great difficulty in dealing with it. Messrs. Spicer, the proprietors of the largest mills, had spent £3000 in various attempts to deal with it in a satisfactory manner; and they had failed. The tanneries were situated principally about Godalming and Guildford. They were being dealt with by the Rural Sanitary Authority of Guildford, and with some success. In one case there was a Local Government Board Inquiry, and a prosecution before the Guildford Assizes last year; but an arrangement was come to under which the matter would be dealt with satisfactorily. These questions had been under the consideration of the Guildford Rural Sanitary Authority, who, not being polluters themselves, had during the last ten years been very active in endeavouring to stop the mischief, though not with so much success as could be desired.

The CHAIRMAN: You say that the matter was to be dealt with in a satisfactory manner. Would you make that a little more definite?

Witness replied that they had an agreement with the landowners for an acreage of land which was judged to be sufficient for the purpose of filtration, so that nothing should pass into the stream until it had been most effectually purified, as far as this could be done by filtration through land. The tannery above Godalming, which had been a source of serious pollution, was to be taken into the main drainage scheme of that town. The Committee of the County Council had been in communication with Godalming, and, in fact, with all the Local Authorities, and had had very many meetings and conferences, in order to induce them to press forward some schemes of sewerage. The Town Council of Godalming adduced to the Committee reports of a gentleman in whom he had very great confidence (Dr. Stevenson), showing that the water left their boundaries in a much better state than it entered them. He accounted for this by the samples not being collected intelligently, but being taken during certain hours, with an object. Witness proceeded to justify the action of the County Council, and to say that, from the evidence which was tendered by the Thames Conservancy, it would appear that they were the only body who had taken up this work, whereas it was really being done, and with some efficiency, by other bodies.

The CHAIRMAN remarked that witness need not justify the action of the County Council to the Commission; and he did not think the Thames Conservancy would say they were the only body who had interested themselves in the matter.

Witness (proceeding) said that Woking, which was on the Wey, was supplied with water by a local Water Company, who drew their water from the chalk; and Godalming and Guildford had also local supplies, which were not obtained from the river. Replying to a question as to whether the jurisdiction of the Surrey County Council extended such a distance into the Metropolis as to be interested in its water supply, he said it did not enter the Metropolis at all; but two of the Water Companies—the Lambeth and the Southwark and Vauxhall—supplied a large part of the population adjoining the river. Under the Local Government Act, that part of the county of Surrey which was Metropolitan was taken out of Surrey, and put into the county of London. Nevertheless, there were districts, such as Richmond, which were partly supplied from local works, and partly by the Southwark and Vauxhall Company. Wimbledon, and large and populous places such as Kingston, and part of Esher, were all served, in whole or in part, by the Metropolitan Water Companies. Then, again, they were interested because the West Surrey Water Company's works at Morden, higher up, supplied the greater part of the Chertsey district, which made the Chertsey Local Authority more anxious in looking after the purity of the water than they might otherwise be, as they drank it themselves. Witness described the steps that had been taken by the Chertsey Rural Sanitary Authority to have the drainage cut off from the river in 26 cases, the principal one of which was at the Gordon Boys' Home at Chobham. The Local Authority, in accordance with their practice, not only gave an order to cut off, but specified how the nuisance was to be remedied; and plans were prepared by the Surveyor to the Authority, which were accepted and carried out.

By Mr. MANSERGH: The schemes about to be put into operation at Godalming and Guildford were those of precipitation and filtration through land. In Weybridge and Chertsey, nothing had been done since December, 1888, as the Authority became rather frightened by the rejection of their schemes by the Local Government Board, and by the opposition they encountered from the Thames Conservancy and the Water Companies. But they were now endeavouring, through the County Council, to throw a little more light upon the subject; and he had great hopes of getting schemes for Weybridge and Chertsey before many months had passed.

Mr. MANSERGH: It is a very important district.

Witness: It is. The district has suffered very much from the absence of a proper drainage system. The people want the best possible scheme; and, what is more, they are willing to pay for it.

Dr. OGLE: I should like clearly to understand upon whom devolves the duty of putting the Rivers Pollution Prevention Act in force. Is it upon the County Council?

Witness: The duty is imposed on two bodies—the Thames Conservancy and the Rural Sanitary Authority. The County Council have also concurrent duties.

When the County Council wish to exercise their power, do they do it directly, or through the Sanitary Authority?—We have hitherto endeavoured to work through the Sanitary Authority, and we have not found it necessary, in anything that we have done, to take legal proceedings. The Sanitary Authority have indisputably the power of doing it. In the case of the Lea, it is different; the Lea Conservancy being the only body having the enforcement of the Rivers Pollution Prevention Act. He believed, however, that this was the only case of the kind in the country. On the Thames, in consequence of the Conservancy having concurrent duties, the County Council had been rather reluctant to interfere; being desirous to avoid any friction.

The CHAIRMAN: On the principle of never doing yourself what you can get anybody else to do for you.

Witness said no doubt that operated in this way: If he saw a member of the Rural Sanitary Authority, and said to him, as he had done, "You ought to have another inspector, as one inspector and an assistant are not enough for the Chertsey district," he would answer: "Oh, but the Thames Conservancy are paid for doing this work. They get £18,000 a year from the Water Companies." That was the way in which the difficulty worked out.

In further reply to Dr. OGLE, witness gave particulars of an outbreak of enteric fever about a mile from Godalming, in the district of the Guildford Rural Sanitary Authority, which he said was clearly traceable to drinking unfiltered river water polluted at Godalming.

By Professor DEWAR: In the paper-mills to which he had referred, Esparto was used, but the proprietors did not altogether recover their soda. They had attempted it, but did not do it thoroughly. He was aware that, in many of the paper-mills situated elsewhere,

they did manage to recover the soda from the Esparto liquor. In the case of the tanneries, they had tried ferrozone and many other precipitants; and for a time the results were satisfactory, but not permanently so. He believed that its treatment along with the sewage would produce a much better state of things than existed at present, and that when they had all the pollutions scattered, they would be much better able to deal with them. With respect to Chertsey, the precipitation process, with subsequent filtration, was not satisfactory as regarded the polluted water in the road drains, because the quantity of water which flowed into the drains varied so enormously with the rainfall, that it was perfectly impossible to carry out any scheme of this sort. With a public water supply in those districts, it was imperative that they should provide sewers to carry away the additional quantity of water brought in. It was quite a mistake to suppose that they could stop the pollution by cutting off isolated houses which were discovered to be causes of pollution. The way in which these cases were found out was interesting. They were discovered in many cases, not by an inspector going round, but by illness occurring somewhere, which brought in the Medical Officer of Health and the Sanitary Inspector, and they endeavoured to trace the cause of it. For instance, on the 19th of March this year serious cases of diphtheria broke out at Bisley Farm Schools. The Inspector and the Medical Officer, on going round, found 170 boys there, and the contents of the water closets and everything else was flowing into a very foul cesspit, and thence into the stream. This had been going on for many years, and had not been discovered. The mischief had been remedied under a scheme laid down by the Rural Sanitary Authority.

The CHAIRMAN: The Sanitary Authority obviously has means of finding out pollution which are not at the disposal of the Thames Conservancy.

Witness said no doubt the Conservancy had not such means at their disposal. The question of the Bisley Schools had been many times discussed in the newspapers; and the Conservancy had been very active in the matter.

Professor DEWAR: With regard to the Wandle, what is the special pollution in that case?

Witness replied that there was a sort of blanket weed which gave a great deal of trouble there. It was below the intake; but the Surrey County Council held it to be their duty to purify rivers, whether above or below the intakes. On behalf of that body, he desired to say that they felt it to be their interest to carry out the provisions of the Rivers Pollution Prevention Act. There was no fear of realizing the fearful picture which was drawn of what might be the condition of the Thames in the event of the Water Companies' contributions ceasing to be paid to the Conservancy. Surrey had the deepest possible interest in the purity of the river. Richmond, Kingston, Weybridge, and Chertsey were all important residential places; and they might be sure that Surrey alone would take up the work, and would have the support of Middlesex and London, as well as of every County Council in the district, in keeping the river as pure as it was at present—and he hoped much purer.

Mr. *W. D. Whittingham*, Chairman of the Metropolitan Districts (Essex) Water Supply Committee, was next examined. He said the portion of the county affected by the question into which the Commission was inquiring contained a population of 381,709, and had a rateable value of more than £1,500,000. The whole of the district was served by the East London Water Company in a satisfactory manner.

The CHAIRMAN: You deal in your statement, which has been sent to the Commission, with a question which is certainly not remitted to us—as to what may be the future Water Authority of the Metropolis. We have nothing to do with that; and therefore I do not propose to ask you any question on the point. You mention, however, that your anxiety as to the sources of supply is heightened owing to the rapid growth of the suburban districts supplied. What districts do you refer to particularly?

Witness said that Walthamstow and Leyton doubled in population each census; and West Ham went far beyond that. There was ample area yet for expansion of population; and a new railway was being constructed through the district. Only Woodford and Wanstead were not growing so rapidly as the other places. They had two sources of supply—one from the bed of the River Lea, and the other from artesian wells; and they had good evidence that the water from the wells was of much better quality than that which came from the bed of the river, and was filtered.

The CHAIRMAN: Is the district so divided—such as being supplied from different mains, or in any way which you can describe to us—that the portion served by the East London Company from the river and from the wells can be so distinguished as to place the matter beyond doubt?

Witness said that locally they had placed it beyond doubt by analyses and reports. The River Lea supply came in at the south-west of the district; and the supply from the High Beech wells, or the pumping-station at High Beech, entered at the north-east. They had tested it; and where the supplies met, there began to be a less satisfactory service of water in point of quality. The water from the artesian wells was very good, and very much to be desired for the use of the whole district. They took it to be proved that for any increase in the district there was no possible supply from the River Lea, which was now entirely exhausted; and therefore the increased supply must be from those wells. Looking to the growth of population in that part of Essex, they would in future require all the water that was to be had from the district; and it would be extremely dangerous that this supply should be parted with for the Metropolitan area.

The CHAIRMAN: You have no further comment to make, or information to give us, as regards any difference in the quality of the water supplied from the one source or the other in the district with which you are personally acquainted, by its effect upon the health of the people?

Witness: The statistics of that would come from the Medical Officer of the district.

I do not ask you for it; but I thought, from one remark you made, you were leading up to that; and I wished to be sure that you had not forgotten it. We have not gone further into the rest of your statement, which relates to the question of whether you should or should not be represented on any Water Authority in the future, as that is not within the scope of our inquiry.—We feared that this was so; and I must apologize for introducing it.

We are not going to prejudge that question in any form.—As far as the County Council of Essex are concerned, they speak in the report which they adopted; and there is a strong local opinion that we shall require in a few years all the water supply for the district. We therefore ask, if the Commission could grant it, that there should be a separate Water Authority for that area.

How do you know that Chigwell, Chingford, Waltham, Loughton, and Woodford are exclusively supplied by water drawn from deep wells in the chalk?—I know the pumping-station that was used to serve them is discontinued, because water finds its way from High Beech, *viâ* Loughton, down through those districts to Walthamstow.

Are you prepared to say, from your own knowledge, that no water drawn from the River Lea is ever supplied to those places?—To the best of my belief. Of course, the pipes are there, and the Engineer may so arrange that the water might reach those districts from the lower supply.

On what knowledge is this very distinct statement made?—From reports presented at our conference, and from my own knowledge of the supply that reaches me in the Walthamstow district.

In answer to Dr. OGLE, witness said he included that part of the River Lea that was in Essex in the supply which he regarded as ample for their own needs for many years; and he claimed that Essex should have the right to take water from it, if necessary, though they would be extremely glad to do without it. There was no further supply to be drawn from the Lea for any increase in the district. The County of Essex did not object to the present abstraction, but only to any possibly increased abstraction.

By Professor DEWAR: Analysis had proved where the supplies from the artesian wells and the river met. The history of it was this: There were, at times of frost, special complaints about the quality of the water; and the Local Board of the district had the water analyzed at certain points. They were distinctly convinced that they could trace where the supply blended. It was good in the north-east, in the centre of the district it was less satisfactory, and down near the filter-beds in the Lea Bridge district in the south-west it was unsatisfactory. They had some correspondence with the Company upon the matter.

Professor DEWAR: May I ask who made these analyses?

Witness: The professional gentleman was Mr. Leo Taylor, the Analyst appointed by the Local Board for gas and water, who was a local man residing at Walthamstow, but who practised in the City.

The CHAIRMAN: If it is the case that the High Beech reservoir can be supplied, at the option of the Company, either from Woodford, which is served from the intake of the Lea, or from the Waltham well, your contention that those places were supplied from the artesian wells would fail, would it not?

Witness: I guarded myself by saying the Engineer might pump the water from Woodford again; but I do not know it is ever done.

But supposing water was taken from the Lea into the Woodford reservoir, and from Woodford was pumped up to High Beech, that would be river water, would it not?—That would be unfiltered river water. The filter-beds are entirely south of the Lea Bridge Road.

The Company, in their statement, tell us that "this reservoir, which can be filled either from Waltham Abbey or from Woodford, is situated in Epping Forest, near to the King's Oak, has a capacity of 2,500,000 gallons, and an altitude of 371 feet above Ordnance datum. The Company's high-level district in Essex is served by gravitation from this reservoir." As regards Woodford, they say: "These works comprise two covered service reservoirs with a joint capacity of 3,000,000 gallons, engine-house, boiler-house, stores, offices, and so on; and the head water-level in these reservoirs is 171 feet above Ordnance datum. There are about 4 acres of land available for the construction of additional covered reservoirs; and there are two engines of 60-horse power for pumping to the high-level districts." It is obvious, is it not, that in their discretion, they may fill the High Beech reservoir from the wells or with the water taken from the River Lea?—It might be done. If that is their statement, I take it to be so; but I understood it was filled from the well.

Mr. MANSERGH: As a matter of fact, did not they supply Woodford before the well was sunk?

Witness: Certainly. It is an engineer's question, and one with which I am hardly competent to deal.

Witness concluded his evidence by stating that he wished the Commission to realize that it was a very important matter that the district should retain the supply, in view of its growth.

The inquiry was then adjourned till the following day.

METROPOLIS WATER SUPPLY.

The Quality of the Water in June.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 196,841,885 gallons, as compared with 190,514,651 gallons in the corresponding month of 1891; being at the rate of 251 gallons to each service. Of the entire bulk of water sent out, 99,217,668 gallons were drawn from the Thames, and 97,624,217 gallons from the Lea and other sources.

Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·8; New River, 1·4; Colne Valley, Tottenham, and East London (deep-well) 1·6; East London (river supply), 2·1; Chelsea, 2·3; West Middlesex and Lambeth, 2·4; and Southwark and Grand Junction, 2·5. The untreated river waters gave the following numbers: New River cut, 1·9; River

Lea at East London Company's intake, 3·0; and Thames at Hampton, 3·8. The Thames at Hampton was in good condition; and the water abstracted from this river by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was, for river water, of a high degree of organic purity. It consisted, in fact, mainly of spring water discharged from the chalk and oolite. It was efficiently filtered before delivery. The water taken chiefly from the Lea by the New River and East London Companies was also in good condition. After treatment by the New River Company, it ranked with the deep-well waters in respect of organic purity; while the East London Company, whose intake is about 22 miles lower down the stream, sent out water of superior quality to that of the Thames-derived supplies. Both waters were efficiently filtered before delivery. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic use. that of the Kent Company being especially distinguished for its very high degree of organic purity. The Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the Kent, Colne Valley, Tottenham, East London (deep-well), and New River waters were clear and colourless; while the remaining waters were clear and very pale yellow. The crude river waters presented the following appearances: New River cut, turbid and very pale yellow; the Lea at the East London Company's intake and the Thames at Hampton, turbid and pale yellow. The bacteriological examination of the waters as they left the filters of the various Companies, by Dr. Koch's process of gelatine plate culture, gave the following results: one cubic centimetre of each water collected on June 20, 21, and 23, developed the following numbers of colonies of microbes: New River, 4; Southwark, 11; East London, 12; Chelsea, 16; Lambeth, 17; Kent (from delivery-shaft of pump), 19; Grand Junction, 29; and West Middlesex, 32. Of the untreated river waters, a cubic centimetre of the water from the New River cut developed 416; the Thames at Hampton, 1658; and the Lea at the intake of the East London Company, 2395 colonies of microbes."

Messrs. Crookes and Odling, in the course of their report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the water supplied by the London Water Companies in the past month, as shown by samples taken daily for analysis, say: "Of the 175 samples examined, 11 were found to be very slightly turbid; the remainder being clear, bright, and well filtered. Owing doubtless to the occasional stormy rainfall of the month, several of the samples of water examined had to be described as 'very slightly turbid,'—an expression made use of to signify such a deficiency in brightness as is recognizable only on careful examination. In other respects the entire number of samples examined were found to be of excellent quality, especially in regard to their maintained freedom from colour-tint and excess of organic matter. Thus, taking the Thames-derived samples for comparison, the mean proportion of organic carbon was found to be 0·107 part in 100,000 parts of the water, as against a mean of 0·119 part for the previous month; while the maximum amount of organic carbon in any single sample examined was found to be 0·134 part, as against a maximum for the previous month of 0·143 part—the insignificant differences in amount, or 0·012 part and 0·009 part respectively, being to that extent in favour of the June supply. The mean proportion of organic carbon present in the Thames-derived samples examined during the past half year, terminating on June 30, amounted to 0·131 part in 100,000 parts of the water, corresponding to less than a quarter of a grain of organic matter per gallon."

BIRMINGHAM CORPORATION WATER SUPPLY.

Annual Report and Accounts.

The Water Committee of the Birmingham Corporation issued a few days ago their report and accounts for the year ending March 31 last. It appears that the profit amounted to £3612; but this would have been much larger if it had not been for two causes—viz., the increase in the rates of pay to the employees, and the high price of fuel which prevailed in the early part of the year. In the report presented to the Council in 1891, attention was called to the fact that, in the preceding year, the item of working engines and wages had risen to the unprecedented sum of £23,351. Even this large sum has been exceeded in the past year; and the item appears in the accounts now presented as no less than £23,787. The water-rental is £140,247, as compared with £135,134 in the preceding year; showing the satisfactory increase of £5112. The sum of £3612 being deducted from £14,299 (the amount of the deficiency on March 31, 1891), leaves £10,687 as the deficiency on March 31. The sum of £2000 has been paid to the City Treasurer in respect of interest on the reserve fund of £50,000. The Committee report that they have found it necessary to authorize some important extensions of mains, to meet the wants of growing districts. They have also found that the time has come for dealing in a more complete manner with the requirements of Acock's Green and Solihull. The first supply to these districts was provided as a temporary arrangement from a 6-inch main; but this is now insufficient for the additional service. The Committee have therefore authorized the construction of a 12-inch main, at an estimated cost of £4800. In accordance with the recommendations of the Water Committee, approved by the Council in 1887, certain works have been carried out for the improvement of the Perry Well, including the driving of further headings, so as to increase the yield of water. These works are now complete; and the yield has increased by 500,000 gallons a day. The cost has amounted to £1213, which exceeds the Engineer's estimate by £313. The Longbridge well, engine, and buildings, and also the main from Longbridge to Selly Oak, are now completed; but the yield of water is at present much less than was expected. With a view to its increase, some headings have already been driven through the land under the control of the Corporation; and, if satisfactory terms can be arranged with the owners of neighbouring property, additional headings will be constructed. Referring to the hydraulic pumping scheme, the report states that the station was completed last summer, and was formally opened by the then Mayor (Mr. Alderman Clayton) on July 18. The Committee have recently received from the Engineer a report on the working of the scheme, in which he says that the total cost of the hydraulic stations and mains as laid, up to the year ending March, amounted to £13,412, and the working expenses to £193. During the first part of the half year, there were only two lifts at work, and for a portion of the last quarter six lifts; and now there are eleven lifts at work, two about to be connected, and three more applications within the piped district. The rental from those at work up to March last amounted for the half year to £82 7s.; leaving £111 working expenses in excess of income. The income at the present time is as near as possible at the rate of £400 per annum, which will be about the working expenditure. The quantity of water consumed by the hydraulic power amounted in the half year to 300,000 gallons. To do the same amount of work would have taken 3 million gallons at ordinary pressure, or a saving of water at the rate of 6 million gallons per annum. As enginemen's wages are a standing charge, every new lift connected costs the department only the amount of gas necessary to do the work. The Committee, in conclusion, mention that, in May last, the men asked for certain concessions in connection with their work. After carefully considering the subject, the Committee, while unable to adopt a system of eight-hour shifts, which had been suggested, decided to revise the scale of wages; and the men express themselves as perfectly satisfied with what has been done in this respect.

GLASGOW CORPORATION WATER SUPPLY.

Annual Report and Accounts.

The Water Committee of the Glasgow Corporation have issued their report to the Commissioners for the twelve months from May 31, 1891, to the same date of the present year. The revenue for the year amounted to £167,218—that from the river-supply works being £2704; making together £169,922. The credit balance from the previous year was £16,914; giving a total of £186,836. The expenditure, including annuities and interest, reached the sum of £129,156; that for the river-supply works amounting to £3296. These together amounted to £132,452. The balance was thus £54,384. Of this sum there was placed to the sinking fund account £43,229. The balance carried to credit of the revenue account for the year 1892-93 is £11,154. The total revenue for last year was, as already stated, £169,922; for the previous year, £168,408—showing an increase of £1514. The total expenditure for last year, exclusive of the sum carried to the sinking fund, was £132,452; that for the previous year, £125,055—showing an increase last year of £7397. The works at the lochs, and the aqueduct from Loch Katrine, continue in a good state of repair. The works connected with the new service reservoir at Craigmaddie are progressing satisfactorily. The excavations for the puddle trench have reached a water-tight foundation over the whole length of the embankment, with the exception of 350 feet at the northern end; and it is expected that the whole excavation will be completed by the close of August. The refilling of the trench with puddle is being rapidly carried on; and for about one-third of its whole length, the embankment is within 15 feet of the top. The new Mugdock Tunnel has been used for the conveyance of the whole water from Loch Katrine during the past year, pending the completion of the repairs upon the old tunnel. The works on the Blane Valley section of the new aqueduct, which is 5¾ miles in length, are progressing in a satisfactory manner. Almost all the tunnels on the northern half of the contract are driven through; but as the rock is in many places very soft, a considerable amount of lining is required. The drawings have been prepared for two additional 36-inch mains from the Craigmaddie reservoir to the city; and the works will shortly be let. The quantity of water sent into the city and district daily during the year ending May 31 last averaged as follows: From the Loch Katrine works, 37,832,697 gallons; from the Gorbals works, 4,661,402 gallons—together, 42,494,099 gallons. The average for 1890-91 was 41,956,791 gallons; showing an increase of 537,308 gallons. The river supply works continue in a satisfactory state of efficiency. The quantity of water supplied daily has averaged as follows: For 1891-2, 2,390,512 gallons; for 1890-91 2,132,888 gallons—showing an increase of 624,624 gallons.

The report came up for consideration at the meeting of the Town Council last Thursday. Its adoption was moved by Mr. Waddel, who remarked that the revenue had suffered by a loss of income, owing to the reduced rating in the suburbs which were united to the city during the year—the net loss being £3242. There was, however, an increase of the rates on meter supplies, trade charges, and sundries, which made up the income, and gave an addition upon the year of £1513 13s. 6d.; the revenue for 1892 being £169,922. It was gratifying to know that the income was derived from very low rates. A comparison with other places would show that in Glasgow the domestic rate within the city was 6d. per £1 on the rental; in Dundee, it was 1s.; in Liverpool, 7½d.; in Manchester, 9d.; in Birmingham, 1s. to 1s. 2d.; in Leeds, 1s.; and in Belfast, 10d. The rate beyond the city in Glasgow was 10d. per £1; in Liverpool, 10½d.; in Manchester, 1s.; in Birmingham, 1s. to 1s. 2d.; and in Belfast, 1s. The public water-rate in Glasgow was 1d. per £1; in Liverpool, 6d.; in Manchester, 3d.; and in Belfast, 2½d. The meter-rate in Glasgow was 4d. per 1000 gallons; in Dundee, 7d. to 8d.; in Liverpool, 7d. to 10½d.; in Manchester, 4⅜d. to 2s.; in Birmingham, 6d. to 1s. 4d.; in Leeds, 6d. to 9d.; and in Belfast, 5½d. to 1s. 6d. In Glasgow a working man with a house at £10 rent had a good water supply for 5s. a year, or less than 1¼d. per week. The expenditure of the year was £132,452; being £7397 more than in 1891. This was caused by the extra interest upon the capital for new works, the repairing of the Mugdock old tunnel, and the extra cost of pumping at Springburn. The new works for the additional supply of water had cost a very large sum during the year; making the total capital spent upon them £537,907. When these works were first entered upon, the estimated cost was £1,000,000. Fully one-half of the estimate had been spent; and as yet only about £60,500 was productive of revenue. The amount paid for sinking fund and interest upon unproductive works since 1882 had been £70,132. Had these works not been required, this amount might have gone to a further reduction of rates. But it was now evident that a

large additional supply of water was required; and therefore the new works were necessary, at whatever expense. The Water Committee had, however, endeavoured to get the additional supply without adding to the rates—indeed, these had been reduced; and though the capital of the Trust had been increased to £2,782,937, the Committee had been able to keep up the sinking fund, so that it now amounted to £653,874. They hoped still to complete the new works without extra rating. To enable them to do this, there had been power given in the Bill of this year to postpone for five years the operation of the sinking fund on the new works. The Committee considered the Trust to be in a most favourable condition, and well fitted to meet the demands of the citizens for an enlarged supply of water. They had also to congratulate the Commissioners upon the admirable manner in which their officials managed what was entrusted to their care. Mr. Gale was always ready and willing to further their views; and, from his engineering skill and long experience, he was well fitted to be the designer and overseer of such a great undertaking. Mr. Wilson, as Treasurer, did his work in the finance department in a careful and prudent manner; sparing neither time nor labour in having his books and accounts in excellent order. These two gentlemen, with their assistants, had been doing good work; and merited the approval of the Commissioners and the citizens. The report was adopted.

THE SALE OF WATER BY METER IN BERLIN.

In the JOURNAL for Dec. 22 last year, we noticed briefly a paper on the above subject read at the Institution of Civil Engineers by Mr. H GILL, M.Inst.C.E. The full text of the communication, accompanied by illustrations and valuable statistical appendices, appears in the Excerpt Minutes of the Proceedings of the Institution, from which we make the following extracts:—

It is well known that the majority of water-works send out a much larger quantity of water than the actual requirements of the consumers; and that the excess runs to waste, without benefit to those whose premises it passes, and to the damage of the community. A history of these works would be a record of an incessant struggle to diminish or deter from waste. Parliament has granted them almost unrestricted powers for house inspection. They can prescribe the nature, construction, and qualities of the apparatus for the conveyance and delivery of the water within private property, and can exact fines for non-compliance; but nowhere, in large towns, have these measures and efforts done more than mitigate the evil for a short period. As soon as the efforts were relaxed, owing to the opposition of the inhabitants, the previous condition returned; and the owners of the works have been compelled to expend capital for increasing the supply, knowing well that the outlay need not have been made had it been in their power to prevent the unrestricted freedom of the consumer, with reference to quantity, being abused. This abuse results from ignorance and neglect, and from the indirect way in which the cost, resulting from waste, falls on the individual, in consequence of the system of charges for domestic water prevailing in England.

An improvement can only be effected by a change in the method of assessment of the charges for the water which passes through the service-pipe of the consumer. So long as these bear no relation to the quantity of water delivered—being dependent on the rental of the premises, the number of the rooms in the houses, or the number of water-taps or other water appliances—the consumer has no inducement to use water economically, or, provided sufficient is delivered for his purposes, to keep the apparatus in such repair as to avoid waste. The quantity of water which passes through his fittings, whether wasted or not, does not affect his water-rate. Thus the system of charge, which permits an unlimited consumption to each householder, in return for a limited and fixed payment, is prejudicial to the community. Works constructed for a definite population, on the basis of an ample supply per head, which should suffice till the population contemplated in the design is reached, become rapidly insufficient, in consequence of the unjustifiable demands, from the satisfaction of which there is no escape; and a premature enlargement of the works is necessitated. This process repeats itself continuously—involving additional works out of all proportion to the actual requirements and increase of the population.

It was on this system that the Company which supplied Berlin from 1856 to 1874 sold water to the citizens. The concession, which would have expired in 1881, prescribed a constant supply, and allowed a charge of 4 per cent. on the house rent for water for domestic purposes, including the supply for baths and water-closets. Extra charges were permissible for trade and garden purposes. All the water had to be delivered under a pressure sufficient to reach the highest floors, at a maximum height of 66 feet above the street. The water was then, as now, drawn direct from the mains; there being, as a rule, no cisterns, even for water-closets, within the houses. In 1865, before the population supplied had reached the number for which the works had been constructed, extensions became necessary. The waste of water was excessive; nor could it be prevented, or even checked, by house inspection. The power existed to cut off the supply; yet this, even in cases of gross persistent abuse, had to be exercised with great discretion. Negotiations for the prolongation of the concession were in progress. It was imperative, under these circumstances, not to check the rapid increase of customers then taking place, to satisfy all, and yet to husband the supply as far as possible. The position of the Company was critical. There was a justifiable reluctance to call up the unexpended capital, unless there was a probability that the whole would continue to yield an adequate interest, and the works realize a fair value on the expiration of the concession in July, 1881. The author, who had been Engineer and Manager of the undertaking since its opening, recommended a tentative change in the method of charge, with a view to its eventual sale exclusively by measure; believing that the difficulties of the position could be most readily overcome by this course. This was approved; the capital was issued; and the extensions (filters and engines) were carried out.

It was determined that a meter suitable for the sale of water for domestic purposes by measure must fulfil the following conditions. (1) Occupy but little room; (2) be readily fixed and detached; (3) be relatively cheap; (4) register within the limits of 2½ per cent. of accuracy, under all differences of level, up to 66 feet, between the entrance into the meter and the point of delivery, giving very varying speeds of supply; (5) not cause a material reduction of pressure by passage through the meter at the maximum speed; (6) under no circumstances stop the supply. This last condition excluded the use of piston meters. Another indispensable stipulation was that the seller of water must be the owner of the meter, with the right, under conditions, to examine and change it at will. In 1865, and for some years subsequently, there were few high-pressure meters which could even approximately fulfil these conditions. The meters in use for the few large consumers in Berlin at this time were the Siemens (Guest and Chrimes) reaction or turbine meters. The water-rate was a charge of 4 per cent. on the rental; and the tariff prescribed that water would only be delivered by meter when a fixed payment of 96 marks (£4 14s.) per quarter was guaranteed by contract. For this sum the consumer was entitled to 844 cubic metres (185,000 gallons). For each cubic metre (220 gallons) in excess, 7½ pfennige (0·9d.) had to be paid, equivalent to 4d. per 1000 gallons. This stipulation almost prohibited the sale of water by meter for domestic purposes. The charge of 4 per cent. on the annual rental, where rents are as high as in Berlin, amounts to a large sum per quarter. By a reduction of the fixed quarterly charge for supply by meter to a sum appreciably less than 1 per cent. of the rental, it would be to the advantage of the consumer to take water by meter; and this course was adopted.

Blocks of buildings with the heaviest rentals were selected for the introduction of the meter for domestic supply. The cost of a very liberal quantity of water per head, per quarter of a year, at the meter tariff price, was estimated, to which a percentage, to cover defects in registration, was added. This sum, which was considerably less than the 1 per cent. of the rental, was made the minimum quarterly payment for a domestic meter supply. For each 220 gallons in excess of the quantity fixed, the tariff price had to be paid. The offers of a supply on these terms were readily accepted by the customers selected; and a small number of domestic meter consumers were thus secured. This little body of meter services was closely watched, the owners warned when the fittings were found defective, and the meters occasionally changed and tested. The owners very quickly recognized the necessity of keeping the internal services and apparatus in a sound condition, and avoiding waste. The caution with which the change was carried out is shown by the fact that from 1865 to 1870 the domestic meter consumers had only increased by 1156. From 1870, however, the process was pushed forward as rapidly as possible; the Company being satisfied with the results, both technical and commercial, of the system, and the house-owners being pleased with the reduction in the quarterly water-rate.

At the close of the year 1873, the Municipality of Berlin purchased the water-works at a price satisfactory to the shareholders, and retained the author as Engineer and Manager. The works then acquired lay to the east of the city; they could deliver 13,200,000 gallons of water per day, and supplied merely the heart of the town. Designs for new works, to the north-west of the city, capable of delivering 19,140,000 gallons in 24 hours, were laid before the Municipality by the author in 1874. The scheme was approved; and one-half of it was completed and put in action in 1877. The remaining half, with the corresponding extensions of the mains of the city, was opened in 1885.

In May, 1878, the Municipality, on the recommendation of the author, resolved to discontinue the system of charging for water by a percentage on the rental, and from the 1st of October of that year to sell it, like gas, solely by measure. The transition from the system of supplying water at discretion for a fixed sum, to the system of supplying exclusively by measure—a process which, commenced in 1865, was only completed in September, 1878—is shown in the following table:—

Date.	House Services Connected with Mains.	Consumers Supplied by Meter.	Percentage of Meter Consumers.
	No.	No.	Per Cent.
1865. At close of year.	4686	47	1
1870. " "	6598	1203	18
1875. " "	9010	6937	77
1877. New water-works opened . .	10,245	8196	80
1878. On the 1st of October, when the use of a meter became compulsory	10,638	10,638	100*
1879-80. At close of financial year .	14,941	14,941	100
1884-85. " " " .	18,216	18,216	100
1889-90. " " " .	21,038	21,038	100

* The percentage of meter consumers on the previous day was 85.

The system of flats is universal in Berlin. Each house is a block of buildings containing several distinct dwellings, and 67 inhabitants on the average in 1890. Each house receives water from the mains through one service-pipe; and it is exceptional for a house to have more than one. A shut-off cock, beneath the footway, controls this house-service from without. Another shut-off cock is also placed within the premises (in the basement or cellar if the house stands at the street front, or in a specially built brick vault if the house stands back from the street) for the use of the owner, about 3 ft. 3in. from the street frontage. The meter stands immediately behind this stopcock; and behind the meter is another stopcock. The meter, with the two stopcocks, is enclosed in a wooden box, built up on the floor, and provided with a moveable cover, so sloped that no articles can remain on it. This apparatus and the service-pipe, commencing in the street, 6 ft. 6 in. from the front of the premises, and extending to about 3 ft. 3 in. beyond the box in which the water-meter is enclosed, are delivered and fixed by the water-works officials at the cost of the house-owner. The remainder of the service and fittings is furnished by tradesmen. No further control over these internal fittings, beyond that which is prescribed in the tariff and regulations, is exercised by the Municipality.

For the control of the meters, the city is divided up into 44 water-meter districts, each containing about 500 meters, and is in charge of a water-meter controller. There are four foremen controllers, each inspecting 11 districts. Each meter has to be visited once in 30 days. The date of the visit and the reading of the dial must be entered by the controller in his pocket register, and also in the journal of his district in the central office. The foreman controller checks the doings of his brigade by unexpected visits to the meters in the districts, and notation of the reading of the dials. A comparison of these with the entries in the journals in the central office enables him to judge how his men are working. After a few visits, each controller can see from his book whether the consumption since his last visit has been normal or exceptional. If the latter, he inquires of the landlord the cause, and, if necessary, inspects the interior fittings with him. If defects are found or waste discovered, the controller reports them at the central office, and the house-owner receives a written notice of the facts. This notice is referred to in case the owner, at the close of the quarter, appeals against the amount of the quarter's water bill. If, however, no defects or carelessness are found, the controller consults his foreman; and, if then it is deemed necessary, the meter is at once changed for another, and tested in the shops of the water-works.

Berlin has on trial some hundreds of meters in which the varying pressure of the passing water automatically and simultaneously reduces or enlarges the areas of the orifices of impulsion, and of the orifices of exit; thus ensuring at the lowest speed sufficient impulse to rotate the vanes, and increasing at the highest speed the delivery capacity of the meter, inasmuch as the sum of the areas of the orifices of delivery can be made approximately equal to the area of the supply-pipe, and affording at all speeds a very close approach to accuracy. Meters of this type of 50 mm. (2 inches) diameter and more are a success; but for meters of 25 mm. (1 inch), further trial is necessary. In Berlin, the meters run, on an average, from three to five years (depending on the quantity of water which has passed through them before being changed). The repairs then necessary, if any, are inexpensive. A rent of 10 per cent. on the value of the instrument is paid by the consumer. This suffices to cover all expenses of repair and renewal, and also to pay the interest on the capital cost.

At the close of the financial year 1889-90, Berlin had 21,873 Siemens meters in stock, of which 21,038 were in action; 129 in use, tandem with another meter for control; and 706 in reserve or repair. About 83 per cent. of the meters are 1 inch; and these represent 75 per cent. of the meter capital.

The tariff of charges is framed so as to compensate in some degree for the recognized failure of the meter to register water passing through at a very small speed. The unit of charge is the highest for a small quantity, and decreases by steps with the increase of quantity delivered in each quarter of the year, yet in such a manner that every consumer, in his progress to the lowest price, pays the unit charge prescribed in each of the steps he has passed through. The objection that by this the poorer are unfairly burdened, as compared with the richer classes, is not valid in Berlin, inasmuch as the blocks of buildings in which the poorer classes live contain more families than those in which the middle and upper classes dwell. Consequently, the water delivered per quarter to the blocks in which the poorer classes predominate, generally exceeds in quantity that delivered to the blocks in which the richer classes form the majority. The unit of charge (quarterly water charge divided by quarterly water quantity), therefore, for the richer classes exceeds that of the poorer; and thus the price per family, or per head, is much less for the poorer classes than the richer.

The circumstances that cisterns are almost unknown in Berlin, that the system of constant supply is adopted, and that on an average each service has to supply 67 persons, have undoubtedly contributed to the success, from a technical point of view, of the sale of water exclusively by measure. It has been urged that, where these are less favourable than in Berlin, the sale of water exclusively by measure cannot be adopted; that where each house-service pipe has to supply few people, or where the water is delivered through cisterns, the meter will fail to register the quantity of water entering the premises; and that the rent of the meter might, for the small houses, equal or exceed the value of the water delivered, and thus render the system inadvisable. A general refutation of the last objection cannot be made. Its correctness or fallacy can only be decided after examination of the circumstances in each city. Without taking into consideration other factors of perhaps equal, if not greater importance, and looking solely to that of the water-works, the question of the adoption of the meter system of supply, or the system of supply at discretion, is a pecuniary one, dependent on a comparison of the cost of the works required to give a supply practically unlimited, with the cost of the works sufficient to satisfy liberally all demands except waste, and, in addition, the cost of the meters and their inspection. In the larger cities of Germany, in consequence of the stringent regulations enforced to prevent the pollution of lakes and streams, the question of the disposal of sewage water has to be considered in connection with the supply of water, and affects in no small degree the method of charge for water.

However valid the objections urged may appear, the system of the sale of water exclusively by measure has become prevalent in German cities, and is spreading rapidly. In May, 1891, Berlin received notice from the Municipality of Hanover that it had resolved to adopt the system of supply exclusively by meter; and from the Municipality of Halle, that the introduction of this system there was under consideration, and would, in all probability, be shortly adopted. Vienna, from the opening of its gravitation water-works in 1873, sold water at discretion; but it has comparatively lately adopted the system of sale exclusively by meter.

Market Rasen Water Company.—The annual meeting of this Company was held yesterday week. The report submitted by the Directors stated that the present condition of the works was satisfactory, and the water supply adequate and excellent. Out of the balance of £708, it was decided to pay a dividend of 6 per cent. per annum, free of income-tax.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The question of the disposal of the surplus of £49,962, which was earned by the Edinburgh and Leith Gas Commission last year, is likely to give rise to a good deal of discussion at the meeting of the Commissioners on Monday. The Commissioners are bound to set aside to a sinking fund £8463; leaving £41,499 to be applied as the Commissioners shall direct. Already three proposals have been made for the appropriation of this sum. Mr. Pollard will move that £11,535 be set apart for the redemption of annuities—purchasing them as they come into the market; that £7050, the cost of laying new mains last year, be paid; and that the balance of £22,912 be carried forward. Bailie Steel will propose that, after contributing the necessary sums to the sinking fund and paying for the new mains, the balance of £34,447 be carried forward. Mr. John Jamieson will move that, beyond the necessary contributions to the sinking fund, there be no appropriation of the balance until the price of gas again falls to be dealt with. The last motion means postponement of the allocation for about two months, which would not be much of a benefit, seeing that any appropriation of the balance on Monday could be made with a view to affecting the price in the manner desired by Mr. Jamieson. If it were taken first and adopted, the Commissioners would then not require to deal with the other motions; though the proposers of them could speak in support of their own views in the discussion on Mr. Jamieson's motion. If it were rejected, the other two motions might then be dealt with almost without discussion. The only difference between Mr. Pollard's and Bailie Steel's motion is in the proposal to purchase annuities. I certainly favour Mr. Pollard, because any reduction of annuities means a permanent relief to the Commissioners; and whatever permanent relief is obtained will always be a relief to the community in the price they have to pay for gas.

I hear that a very valuable discovery has been made in connection with the experiments at the Leith gas-works in the manufacture of gas from oil. The nature of the discovery I am not at liberty to disclose at present, because discoverer is about to have it patented; and I mention it now in view of the discussion at Stirling next Thursday upon the paper by Mr. J. Mackay, of Peterhead, upon his experiments in the manufacture of oil gas. If the expectations of the discoverer are fulfilled, there will no longer be any doubt as to the suitability of mineral oils for gas manufacture.

It is announced that during the past year 458,262 tons of coal were carbonized at the three stations of the Glasgow Gas Trust, as compared with 420,153 tons in the preceding year—an increase of 38,109 tons. This speaks well for the output of gas, the figure for which may be expected in a day or two.

The Berwick and Tweedmouth Gas Company is in the hands of an extremely capable Manager in Mr. Walker, a Falkirk man, who was trained by Mr. Hislop at Paisley, and who holds the certificate of the City and Guilds of London Institute. This year the Company's report, which was read at the annual meeting on Wednesday, was (but for one item of loss for which no one is responsible), the best which I recollect them ever having the pleasure of hearing. The income during the past year was £5792, of which £5159 was from the sale of gas, £122 from meter-rents, and £510 from residuals. In the preceding year, the revenue from gas was £4935; from meters, £126; and from residuals, £559. The expenditure this year was £4616; and the balance of profit, £1176. A dividend at the rate of 10 per cent., the same as last year, was declared; and the price of gas was reduced from 4s. 6d. to 4s. 5d. per 1000 cubic feet.

The Arbroath Gas Corporation, which is managed by Mr. R. S. Carlow, the obliging Secretary of the North British Association of Gas Managers, in the matter of finance sails very near the wind. The Corporation had their annual accounts before them on Wednesday; and these showed a revenue of £10,865, with a surplus of profit of £3 2s. 7d. It is, perhaps, as well that the surplus should not be large; because the Corporation is burdened with the iniquitous condition of paying over half their surplus to the Town Council, to be devoted by them to public improvements. This year there will not be much to hand over; and if the Corporation could otherwise manage their business satisfactorily and keep down the surplus, they would act wisely. Of their total revenue for the past year, £9945 was derived from gas, at 4s. 7d. per 1000 cubic feet, and from meter-rents. A year ago the revenue from gas, which was then, however 4s. 2d. per 1000 cubic feet, was £8805; so that the raising of the price has affected the natural increase of the output of gas. It has not, however—and this is exceedingly satisfactory—resulted in a decrease in the output, which was 46,470,500 cubic feet, an increase of 339,220 cubic feet upon the preceding year. The increased output has also been obtained from less coal. The quantity carbonized last year was 4707 tons, or 265 tons less than in the previous year; and the yield per ton was 9872 cubic feet, or an increase of 595 cubic feet. Gas unaccounted for has, however, increased from 6·694 to 8·254 per cent. Mr. Carlow's accounts are prepared with such care, and are cast in such an intelligent form, that one is able, from the report, to cull these figures at a glance. How different it is in many instances, where such things as balances are entered without stating whether they are debits or credits, and the whole thing is mixed up as if the intention was to mystify rather than to explain. Mr. Carlow deserves congratulation upon this point, as well as upon his management of the works, which has to be conducted in the face of unusual difficulties. During the year, it was stated, all that had been expended on new works was £203. The Corporation have estimated this year for a revenue of £10,852, and an expenditure of £10,836, with an expected surplus of £26.

The annual meeting of the Montrose Gas Company was held last Wednesday, under the presidency of Mr. A. Dickson. The report of the Directors showed that the total income from all sources last year amounted to £6244; and the expenditure, including an allowance for deterioration, to £4868—showing a surplus of £1376. Adding £301 the balance on the previous year, the total available surplus was £1677, out of which the Directors recommended that the usual dividend of £3 per share should be paid. This would require £1500, and would leave £177 to be carried forward. The Chairman, in a brief speech, went

over the details of the accounts; pointing out that last year there had been an increase of expenditure for coal of about £450 as compared with what was spent in the previous year. The balance in hand at the end of July, 1891, was, he stated, £301, as against £177 now. Then he pointed out that in all probability there would be a falling off in the revenue from tar, &c., of between £200 and £300 at the end of the year now commencing. However, the Directors thought they could make the recommendation they had done without encroaching in any way on the reserve fund. This was unanimously agreed to. Mr. T. Douglas Hall was unanimously re-appointed Manager; and Mr. A. Melville Watt, Secretary and Treasurer.

In Kirkcaldy, where Mr. Adam MacPherson, the President of the North British Association of Gas Managers, reigns in gas matters, the Directors' report shows a consumption of gas amounting of 72,740,000 cubic feet, an increase of nearly 2 million cubic feet. Last year the increase reported was from 64,845,000 to 70,881,000 cubic feet; so that there is an increased consumption, in two years, of 6 million cubic feet. This increased consumption is the more satisfactory, that it was experienced in the face of a rise last year of 2½d. per 1000 cubic feet of gas, which is now 5d. higher than it was two years ago. The profit for the year was £3182, a decline of £436, due to the high price paid for coal. The coal contracts, it was stated at the annual meeting of shareholders on Tuesday, have been secured this year on more favourable terms, which enables the Directors to continue the price of gas at 3s. 6½d. Even at that price, it is still exceedingly low, which is doubtless the result of Mr. MacPherson's excellent management.

The Greenock Gas Trust has, it is thought, received a check in its financial affairs; but I must say I fail to see it. There is a peculiar arrangement in Greenock, which is bound at times to lead to confusion, as, I believe, it has done on this occasion. The Gas Trust closes its year on July 31 or Aug. 1. But it is bound to make a contribution to the Police Board's funds every year; and as the Police Board, like others, works from May of one year to May of another, its finances come up for adjustment at their July meeting. This leads to a sort of balance-sheet of the Gas Trust being made up as for the year ending June 30. This balance-sheet came before the Police Board this week, and gave rise to a good deal of discussion. What troubled the members was that they had made up their estimate for the past year on the faith of a promise by the Gas Trust of a contribution of £1427. The balance-sheet of the Gas Trust, however, shows a deficit of £1033; the revenue being given at £40,309 and the expenditure at £41,342. The profits estimated by the Gas Committee last year were £840; but the Finance Committee of the Police Board afterwards increased this to £1427, the whole of which they were to appropriate. The Police Board are really the undertakers of the gas supply in Greenock; and what is called the Gas Trust is little more than a Committee. There is nothing wrong in such an arrangement. But it is foolish to have the financial years of the two bodies not coincident; and it was decidedly wrong of the Police Board to take it upon themselves to increase the expected surplus from the gas undertaking. The explanation given of the position of the Gas Trust finances was chiefly that there had been an increase in the amount paid for coal from £12,896 to £16,793; and a decrease in the amount received from residuals from £6382 to £5389. A deficit has not arisen in the finances of the Gas Trust since 1874; and the members were the more disappointed at last year's result upon that score. It was, however, stated that there are about 1000 tons of cannel more in stock this year than last, which is almost sufficient to square the account. There was an increased output of gas by 19 million cubic feet, which is doubtless the explanation of the great rise in the price of coal, and which brought along with it a greater gross reduction in the amount received from residuals. But an increasing business should be a source of gain, and not a drawback; and it would doubtless have been so in this instance but for the operation of "milking" the Gas Trust which the Police Board indulge in. It is to the credit of the Gas Trust that they did not attempt to shirk their responsibility to the Police Board, Instead, the Vice-Convener of the Gas Trust moved that the Trust withdraw £2500 from the contingent fund of the Trust—which, since 1874, has stood at about £4468—and out of that sum to wipe off the deficit of £1033, and make the promised contribution to the Police Board. In making this proposal, the Vice-Convener said that for 19 years the balance of the gas account had always been to the credit side, ranging from £7000 to £2000; and now they were confronted with a deficit of £1033. Notwithstanding, if they looked at the sinking fund, they would see there had been a profit on the making of the gas of £2000; but, according to Act of Parliament, they must appropriate £3000 every year to the sinking fund. The proposal was agreed to, on the understanding that the Committee of the Gas Trust should hold a special meeting to inquire into the causes of the deficit.

The annual accounts of the Peterhead Gas Commissioners were presented on Monday. They showed a revenue of £4778, as compared with £4794 in the preceding year; and an expenditure of £3746, against £3459. The balance was £1032; but out of that there required to be made a contribution of £430 to the sinking fund, and £660 was chargeable for interest, which left a deficit of £162. The Commissioners are working upon the enlightened policy of endeavouring to avoid raising the price of gas from 5s. 10d., at which it has been now for two years; and they rely upon the fall in the price of coal enabling them to wipe off the debit balance, and to have a balance of profit of £110. It is a circumstance which will be looked upon with interest, that, notwithstanding the employment of oil for gas-making by Mr. Mackay, the Manager, during the past year, the cost of coal was not decreased, but, on the contrary, rose from £2161 to £2227. Meter-rents are to be abolished.

The annual field-night of the Paisley Gas Commissioners was held on Thursday, when the close of a very successful year was reported. During the year, the quantity of gas sold was 235 million cubic feet. In 1871, when the Commissioners took the concern over, it was only 85 millions. The receipts amounted to £39,229, and the gross expenditure to £32,190; leaving the balance of profit and loss at £7039. After making provision for the interest on mortgages, for feu-duties, &c., there was a net surplus left of £3930. It was agreed (two members dissenting) to apply the entire surplus to the liquidation of the debt of the Improvement Trust—another instance of imposing a burden upon the gas undertaking which it should not bear. It was resolved to borrow £20,000, to carry out extensions at the gas-works. The proposal to do this was ridiculed by Mr. Macfarlane, the Convener of the Gas Commissioners, as absurd, when they had just voted away nearly £4000 of their own profits to town improvements.

The Forfar Gas Corporation accounts for the past year show a profit of £326. The total income was £6713; and the expenditure, £6386. Of the revenue, £5482 was derived from the sale of gas, and £782 from residual products.

In the paragraph in last week's "Notes," dealing with the accounts of the Alloa Gas Commissioners, a typographical error made the price 5s. 4d. instead of 3s. 4d. per 1000 cubic feet; and at the latter figure it is to be retained.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 23.

Sulphate of Ammonia.—There is little to be reported. Both supply and demand are in a narrow compass; and consequently the fluctuations are insignificant. At Hull and Liverpool, £9 17s. 6d. is said to have been accepted; but certainly large quantities could not be bought at this price. The importance of the scarcity of supplies will probably be more felt next month; but the course of prices will depend very much upon the demand. If it remains on the present basis it is unlikely that the anticipated improvement in values will take place. The position of this commodity has never been more favourable; but statistical arguments seem to have very little value in these degenerate days. Nitrate is again dull; 8s. 3d. per cwt. being the spot value.

LONDON, *July* 23.

Tar Products.—Of these products, the article most attracting attention at present is carbolic acid, for which there has sprung up a great demand on the Continent, caused by the cholera visitation. Crude carbolic has advanced about 3d. per gallon, and crystals from 1d. to 2d. per pound, with every indication of higher prices still being available, as the stocks are not thought to be heavy, and the make is at its lowest. Pitch maintains its value. Benzol is steady, at last week's prices; and anthracene is, if anything, a shade weaker. Values may be taken as follows: Tar, 8s. to 10s. 6d. Pitch, 27s. Benzols, 90's, 1s. 8d.; 50's, 1s. 3½d. Toluol, 1s. 2d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 7d. Creosote, 1d. Naphthalene, 25s.; pressed, 45s. Carbolic acid, crude 60's, 1s. 6d.; 70's, 1s. 8d.; crystals, 7d. Creosol, 1s. 2d. Anthracene, 30 per cent., "A" quality, 9d.; "B" quality, 6½d.

Sulphate of Ammonia remains steady at from £9 15s. to £10, less 3¼ per cent.; and the make is moving off steadily between these prices. Gas liquor (10-oz.) is quoted at 5s. 6d. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—All descriptions of round coal continue in very slow demand throughout Lancashire, with stocks accumulating. As regards the better qualities, they are moving off fairly well; but in the lower qualities, the demand is being very appreciably affected by the depressed condition of most of the coal-using industries throughout this district. In the better qualities of round coal, prices are being fairly well maintained; and where contracts have been renewed for the ensuing year's supplies, they are, as a rule, based upon current rates. For prompt sales there is, however, generally some slight giving way upon list rates; but this may be regarded as only a temporary weakness in the market during the slack summer season. For present temporary sales, best Wigan Arley coals scarcely average more than 11s. 6d. to 12s.; Pemberton four-feet and second qualities of Arley, 10s. to 10s. 3d.; and common house-fire coals, 8s. 6d. to 8s. 9d. per ton, at the pit mouth. Inland sales, for steam and forge purposes, scarcely average more than 7s. 6d. to 7s. 9d. per ton at the pit mouth; but for shipment, prices are cut very low to clear away quantities. In odd cases, very good qualities of steam coal are still fetching about 9s. 3d. per ton, delivered at the Garston Docks, or the High Level, Liverpool; but generally prices scarcely average more than 8s. 9d. to 9s. Welsh coal is competing very keenly at the ports on the Mersey—the best qualities from the Wrexham district being obtainable at 10s. per ton, delivered in waggons at Birkenhead; with common Welsh steam coal offering at about 8s. 3d. per ton. With regard to gas coal, the tone continues rather weak; but the giving way in prices referred to in previous reports represents really about the full extent of the concessions that Lancashire colliery proprietors are prepared to make. I have previously referred to the competition of Yorkshire coal in this district; and rather a strong feeling seems to prevail in many quarters as to the way in which gas coal contracts have recently been competed for. Yorkshire colliery proprietors are roundly blaming the Lancashire coalowners for not adhering to their prices, as was practically arranged at the meetings held some time back at Sheffield; whilst, on the other hand, the Lancashire coalowners blame Yorkshire for bringing about the break down in rates at which contracts have had to be placed. Users of gas coal have, of course, been taking advantage of the unsettled state of the market; and in some instances they have notified that they would decline to entertain any tenders whatever unless they were based upon certain stipulated concessions on the prices of last year. So far as the leading Lancashire colliery owners are concerned, the concessions that have been made have scarcely averaged more than 3d. to 6d. per ton upon the basis of last year's prices; and for the best qualities of gas coal at the pit mouth, prices have not ranged lower than 9s. 9d. to 10s. per ton, with inferior descriptions offering at 7s. 6d. to 8s. per ton. At the pit mouth, good descriptions of burgy average 6s. 6d. per ton; the best qualities of slack, 5s. to 5s. 6d; and medium sorts, 4s. 3d. to 4s. 9d.; but common sorts of slack can still be bought at about 3s. 3d. to 3s. 9d. per ton at the pit mouth.

Northern Coal Trade.—The coal trade of the North is brisk; and the demand for best steam and gas coals is still large. Best

Northumbrian steam coals are brisk at 10s. 6d. per ton, f.o.b.; and most of the collieries are well employed. Second qualities are not quite so fully at work, and are about 1s. per ton less. Small steam coals are dull. Gas coals are firm, with a good demand, which ought to increase as the nights begin now appreciably to lengthen. There have been sales of odd cargoes of gas coals, best Durham qualities, at 9s. per ton for f.o.b.; but the more general price is about 8s. 6d. per ton. Negotiations are now in progress for the largest of the contracts for gas coals for the South of England; but it will be ten days or a fortnight before there is any definite decision on the offers that will be made. Coke has fallen in price. There is now an abundant supply of best Durham blast furnace coke; and the price for shipment may be given as from 15s. to 16s. per ton f.o.b. For local uses a lower price in proportion is quoted. There is no alteration in the price of gas coke; but the production is now beginning to increase locally, and there is not, of course, the large demand for this fuel that there was in the time of the Durham strike.

Scotch Coal Trade.—In view of the holidays, business was so trifling that it is scarcely necessary to say anything regarding the coal trade in Scotland last week, or to give quotations, although generally, it may be stated, prices were easier. But this was probably owing to the temporarily decreased demand. The shipments of coal were 160,989 tons—a small increase over the preceding six days; and an increase of 16,971 tons over the corresponding week of last year. For the year to date, the shipments amount to 3,965,005 tons—an increase of 564,277 tons over the same period of 1891.

Paris Water Supply.—According to the Paris Correspondent of *The Times*, the Municipality last Friday resolved to send commissioners to London and to Nantes to study the system of filtering river water in use in those places; and also to call upon the authorities to make surveys for bringing water from the valleys of the Loing and the Lunain.

The Todmorden Local Board and the Gas Supply of the District.—At the meeting of the Todmorden Local Board last Wednesday, it was decided to purchase the property of the Todmorden Gas Company for £66,462; the gas-works belonging to Messrs. Fielden Bros., Limited, for £20,000; and those of Messrs. Wilson Bros., Limited, for £6500.

New Water Undertakings in Canada.—According to the Montreal Correspondent of *Industries*, considerable additions are about to be made to the water undertakings in Canada. The authorities of the town of Sydney, Prince Edward's Island, have decided to build waterworks. It is proposed to build a 350 million gallon reservoir at Halifax, Nova Scotia, to be formed by a dam 30 feet high and 400 feet long; also to lay a new supply main. Water-works are being projected at Fairville, New Brunswick, by the Fairville Water and Electric Light Company. A stand-pipe system is proposed. Plans for proposed town waterworks are being made at Lachute, Quebec. A system of water supply is also to be established at North Sydney and Stellerton, Nova Scotia.

Exhibitions of Gas Appliances.—Yesterday week, the ex-Mayor of Darlington (Mr. T. M. Barron) opened an exhibition of Messrs. Charles Wilson and Sons' gas-stoves and appliances in the Corn Exchange; and it was continued until Saturday evening. Cooking lectures were delivered twice each day by Miss L. M. Peacock, the Head Teacher of the Yorkshire Training School of Cookery. So successful was the exhibition held at Bury in March last, that the three makers who then exhibited—Messrs. Richmond and Co., Limited, Messrs. C. Wilson and Sons, and Messrs. J. Wright and Co., Lim.—held a second, in the Athenæum, last week. It was opened by the Mayor. The various appliances manufactured by the firms named were exhibited; Messrs. Richmond and Co. showing a new gas washer worked by a laundress.

Excursion of the Dover Gas Company's Employees.—The workmen in the service of the Dover Gas Company had their annual excursion on the 13th inst.; the place selected being Tunbridge Wells. Dinner was served in the Pump Room; and afterwards carriages were provided for a drive to Penshurst Place, which was open for inspection by the party. On the return, tea was served; and at its conclusion the men were addressed by the Chairman of the Company (Mr. W. Mannering). He expressed his pleasure at seeing their enjoyment of the day's outing; and he congratulated them on the continued success of the undertaking, which he trusted would be maintained by the united efforts of all connected with it. He complimented the Deputy-Chairman (Mr. E. Bottle) upon the excellence of the arrangements he had made for the day's excursion (the expense of which, it may be mentioned, is borne by the Directors); and the men responded with cheers. The rest of the time available was spent in a stroll about the town; the return journey commencing shortly after eight.

Unexpected Difficulties in Connection with the Thirlmere Water-Works.—The completion of the entire line of the Manchester Corporation Thirlmere Water-Works will (says a correspondent of the *Preston Guardian*) undoubtedly be delayed a considerable time through the impracticability of the original scheme being carried out at Troutbeck, in the Lake district. It was originally intended to carry the water-pipes across a deep gorge of the Troutbeck Valley by laying them underneath the bed of the river; but after a deal of time had been wasted, and a large amount of money expended, with but a minimum of progress, the scheme has been abandoned, as it was found that engineering science could not make it practicable. The loose nature of the mud rock which had to be cut through was such that, at almost the first flood after the fissure was cut, the adjacent rocks closed up again and firmly knit themselves together. This action, which must have represented a pressure of an incalculable number of tons, would have caused utter destruction to the strongest pipe material that could be manufactured. It is now proposed to cross the deep but narrow gorge by a substantial aqueduct; and active preparations are already in progress to complete the work.

Water-Works for Heytesbury (Wilts.).—Last Tuesday week, Lady Heytesbury turned the first sod in connection with a scheme for providing Heytesbury with a supply of water. The site of the works is in Bowlesbury Knoll, where it is expected that water will be found at a depth of 250 feet. The water is to be pumped into a reservoir, and from thence distributed to the inhabitants by gravitation.

The Price of Gas at Des Moines (Ind).—In our editorial columns on the 5th inst., reference was made to the action of the City Council of Des Moines (Ind.) in settling the price to be charged by the local Gas Company at $1·25 per 1000 cubic feet, and to the quashing of this ordinance by a Judge. We now learn that the Council have passed another ordinance, fixing the gross rate at $1·45, with 10c. discount for prompt payment. This, it is thought, will give rise to another appeal to the Courts.

The Winding-Up of the Lucigen Light Company, Limited.—Under the winding-up order recently made in regard to this Company, the usual summary has been issued. The Company was incorporated in December, 1887, for the purpose of working the patents and inventions for the Lucigen system of producing light, in accordance with agreements made between Mr. E. J. Pape and the Company. The nominal capital was £250,000, which was afterwards reduced to £50,000, and ultimately increased to £60,000. The gross liabilities to creditors amount to £41,010, of which £36,267 are expected to rank; and there appear to be no available assets.

Claim for Damages against the Southwark and Vauxhall Water Company.—At the Kingston-on-Thames County Court recently, Mr. A. Dauney, of Fair View, Coombe Warren, claimed £50 from the Southwark and Vauxhall Water Company for damages to a valuable horse, and for consequent loss occasioned to him. The horse, in February last, while drawing a brougham in one of the principal thoroughfares of the town, stepped into what appeared to be a puddle, but which in reality was a hole about 5 feet in depth, produced by water welling up from a joint in one of the Company's mains. The defendants attributed the cause of the pipe giving way to contraction produced by the coldness of the water passing through. A jury was empanelled to hear the case, which lasted upwards of four hours, and they gave a verdict in favour of the plaintiff for £40 and costs. Execution was stayed to allow of the defendants giving notice of appeal.

The New Water-Works for Pontefract.—Although it was reported fully a month since that the Roall water scheme of the Pontefract Corporation had been completed, it appears, from a discussion which took place at the meeting of the Council last Thursday week, that this was not quite true. The amount of the contract (which was placed with Messrs. Vickers and Sons, of Nottingham) was £22,800; and all this sum, excepting £2000, has been paid. The work should have been finished in February last; and a letter has now been written to the Engineer (Mr. G. Hodson), intimating that the town is in immediate want of water, and asking definitely when the scheme will be completed, otherwise steps will be taken for enforcing the penalty agreed upon in the contract. Considerable trouble is being experienced, owing to the constant bursting of the mains, which are some nine miles in extent; and it is stated that one of the engines at the old pumping-station and those at the Spink Lane station have failed.

Llangollen Water Supply.—In the JOURNAL for the 14th ult., a notice appeared of a report by Mr. T. T. Marks, C.E., on the water supply of Llangollen; and, as then intimated, that document showed the existing system of water supply to be in a bad state—the only remedy being the construction of new works. Since then the Local Board have submitted samples of the water to Dr. Campbell Brown, the Borough Analyst, of Liverpool; and, as the result of his analysis, he reports that the "samples are excellent water for domestic use, and compare favourably with other water from similar gathering grounds. There is no trace of sewage contamination; and the water is quite wholesome and suitable for drinking purposes." He adds weight to his report by mentioning that several years ago, being a frequent visitor to Llangollen for a few days at a time, he analyzed various samples of the water, as a precaution for his own safety, before he ventured to drink it. The result was so satisfactory that he had used the water without hesitation ever since. The quality of the water, he maintains, is as good now as it was then; and he should continue to drink the water with confidence.

Electric Lighting for Yarmouth.—The Committee of the Yarmouth Town Council who have in hand the question of providing an installation of electric lighting for the borough, have drawn up a set of conditions and instructions for the use of those who desire to send in tenders. It appears therefrom that the Council are only contemplating the carrying out of such work as is absolutely necessary to comply with the terms of their Provisional Order at the smallest possible expense, consistent with good workmanship. The Council are not at present proposing to light the streets by electricity; but persons tendering are at liberty, if they can show reduced cost, combined with increased efficiency, to include the whole or some portion of the street lighting in their schemes. For their guidance, the following information is given regarding the cost of lighting the streets by gas: The price of gas in the borough east of the river is 3s. 4d. per 1000 cubic feet, with a discount of 10 per cent. to the Corporation. West of the river the cost to the Corporation for street lighting is 4s. per 1000 cubic feet; to private consumers, 5s. per 1000 cubic feet, subject to discount. The public lamps are kept lighted for about 3400 hours per annum. East of the river gas costs £2 11s. per lamp, and lighting, extinguishing, cleaning, and repairing, 15s.; making the cost of a lamp £3 6s. West of the river the cost of gas is £3 8s., with lighting, extinguishing, cleaning, and repairs as before—making the total cost per lamp £4 3s. per annum (lamps provided with regulators to consume 5 cubic feet per hour). There are, in addition, fourteen larger lights, costing from £10 to £12 each per annum. The number of street lamps is as follows: East side of river, 570 consuming 5 feet per hour, and 14 consuming 30 feet; west side of river, 191 consuming 5 feet. The cost of gas last year in the Corporation buildings was: Town Hall and Municipal Offices, £127; Police Station, £64; Free Library, £38; Fish Wharf, £75; approaches, about £75—in all, £379.

Public Lighting by Oil at Holbeach.—At a special meeting of the Holbeach Local Board last Friday, tenders for the lighting of the town were under consideration. The tender for gas was 40 per cent., and that for electric lighting 80 per cent., more than that foro il; and the last was accepted, although the inhabitants had petitioned in favour of gas.

The Gas Explosion at Coventry.—On Wednesday afternoon, Dr. C. W. Iliffe held an inquiry at Coventry into the cause of the death of Frederick Aston, who died yesterday week from burns received in the gas explosion reported in the JOURNAL last week (p. 129). The evidence showed that the escape of gas was the result of an absence of water in the chandelier; and the jury returned a verdict of "Accidental death."

Extensions of Gas Plant.—Messrs. R. Dempster and Sons, Limited, have been entrusted with the construction of a telescopic gasholder, 80 feet in diameter and 20 feet deep, for the Ulverston Local Board; also with the erection of a condenser and scrubber for the Blackburn Corporation, general extensions at the Rainton Gas-Works of the North-Eastern Railway Company, extensions at the gas-works of the Maryport Trustees, and a set of six large annular condensers for the North Bierley Gas Company.

Sulphur in London Gas.—The return made by Mr. W. J. Dibdin, F.I.C., F.C.S., to the London County Council for the week ending the 16th inst., shows a remarkable increase in the sulphur in the gas supplied by the South Metropolitan Gas Company between the 8th and the 16th inst. At the Tooley Street Station, the mean of the testings for this impurity ranged from 19 up to 22·6 grains; at Blackfriars Road, from 23 up to 26·1 grains; and at Plumstead, from 17·1 up to 25·5 grains. At this station the gas was also, on three occasions during the above-named period, found to be below the standard illuminating power; and on the 15th inst., at Tooley Street, it was 15·9 candles.

Electric Lighting for Wolverhampton.—The question of adopting the electric light at Wolverhampton, came before the Town Council, in committee, on Wednesday last. The Mayor (Alderman Saunders) presided. The Lighting Committee reported that they had considered the borough ought to have the electric light at as low a price as possible, and that the profits which might accrue from supplying it should be devoted to reducing the rates. The price of electric light was calculated at 6d. per unit for Wolverhampton; and the "additional comfort derived from its use as compared with gas, as well as the fact of its being a better illuminating power," had not been lost sight of. The report of the Borough Surveyor and Mr. H. Dickinson, an Electrical Engineer, containing certain recommendations involving an expenditure of £37,000, had received due consideration. The Committee expressed their opinion that the Council should undertake to carry into effect the provisions of their Electric Lighting Order of 1890, by providing all the necessary works for the supply of electricity for public and private purposes within the borough on the lines recommended by Mr. W. H. Preece. This gentleman submitted that the electric light could now compete successfully and on equal terms with gas at 3s. per 1000 cubic feet. Though eventually 50,000 electric lamps would perhaps be fixed in the borough, yet at present it was proposed to provide plant and energy for only 10,000 lamps. He recommended that some of the public streets should be well lighted by arc lamps, and proposed that the tariff should be 5d. per unit. Each lamp fixed would earn 8s. 4d.; and the total revenue would amount to £8333. He estimated at £35,000 the capital expenditure required to build a central station, to supply the requisite plant, to lay down the necessary mains, to supply the requisite arc lamps, and to work the undertaking; and this sum he recommended the Corporation should be prepared to expend. The Council were unanimously in favour of adopting the scheme; and the matter, it is expected, will come up for confirmation at their next meeting.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 152.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½—17½	..	6 0 0
100,000	10	,,	7½	Do. 7 p. c	10	11—12	..	6 5 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	103—107	..	4 15 3
100,000	20	27 May	8	Bahia, Limited	20	10—12	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6—6⅛	..	5 15 9
40,000	5	,,	7½	Do. New	4	4¼—4⅜	..	6 6 4
380,000	Stck.	26 Feb.	12½	Brentford Consolidated	100	212—217	..	5 12 11
150,000	,,	,,	9½	Do. New	100	165—170	..	5 8 9
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	41—43	+1	5 6 11
888,500	Stck.	11 Mar.	5	Bristol	100	95—100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	41—43	..	5 4 8
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	—	—	Buenos Ayres (New) Limited	10	6½—7½	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	92—95	..	6 6 4
150,000	20	26 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	13 Apr.	13	Commercial, Old Stock	100	231—236	..	5 10 2
165,000	,,	,,	10	Do. New do.	100	180—185	..	5 8 1
130,000	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	120—125	+2	3 12 0
800,000	Stck.	15 June	13	Continental Union, Limited	100	218—223	..	5 16 7
200,000	,,	,,	10	Do. 7 p. c. Pref	100	185—195	..	5 2 7
75,000	Stck.	30 Mar.	10	Crystal Palace District	100	185—190	..	5 5 3
486,090	10	29 Jan.	10	European, Limited	10	19½—20½	+½	4 17 7
354,060	10	,,	10	Do. Partly paid	10	14—15	..	5 0 0
5,470,820	Stck.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	219—221	+9	5 7 1
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	94—98	..	4 1 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	250—255	..	3 18 5
30,000	,,		5	Do. F, 5 p. c. Prf.	100	118—123	..	4 1 3
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	169—174	..	4 6 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	157—162	..	4 6 5
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	250—255	..	3 18 5
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	148—153	..	3 18 5
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	114—116	..	3 9 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	119—123	..	3 13 2
908,000	,,	,,	6	Do. 6 p. c. do	100	163—166	..	3 12 3
3,800,000	Stck.	12 May	12	Imperial Continental	100	217—222	+2½	5 8 1
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5p. c. Deb.	100	108—110	..	4 10 11
541,920	20	15 June	5	Monte Video, Limited	20	14—15	..	6 13 4
150,000	5	27 May	10	Oriental, Limited	5	8—8½	+⅛	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2—3	..	—
				People's Gas of Chicago—				
420,000	100	3 May	6	1st Mtg. Bds.	100	106—110	..	5 9 1
500,000	100	1 June	6	2nd Do.	100	100—103	..	5 16 7
150,000	10	15 Oct.	10	San Paulo, Limited	10	8—9	..	—
500,000	Stck.	26 Feb.	15½	South Metropolitan, A Stock	100	268—273	+1	5 13 7
1,350,000	,,	,,	12	Do. B do.	100	220—225	..	5 6 8
200,000	,,	,,	13	Do. C do.	100	230—240	..	5 8 4
725,000	,,	14 July	5	Do. 5 p. c. Deb. Stk.	100	140-144*	..	3 9 6
60,000	Stck.	11 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
743,952	Stck.	1 July	10	Chelsea, Ordinary	100	245—250	−3	4 0 0
1,720,252	Stck.	13 Apr.	8	East London, Ordinary	100	195—200	..	4 0 0
544,440	,,	1 July	4½	Do. 4½ p. c. Deb. Stk.	100	137—140	..	3 4 3
700,000	50	1 July	8½	Grand Junction	50	100—104	..	4 1 9
708,000	Stck.	12 Feb.	10½	Kent	100	258—263	−2	3 19 10
1,043,800	100	1 July	9½	Lambeth, 10 p. c. max.	100	218—223	−4	4 5 2
406,200	100	,,	7½	Do. 7½ p. c. max.	100	191—196	..	3 16 7
279,700	Stck.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	122—125	..	3 4 0
500,000	100	12 Feb.	12½	New River, New Shares	100	325—335	..	3 22 4
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk	100	127—130	..	3 1 6
902,300	Stck.	15 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	148—153	..	4 4 11
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	134—138	..	4 14 3
1,155,066	Stck.	15 June	10	West Middlesex	100	238—243	+1	4 2 4
						*Ex div.		

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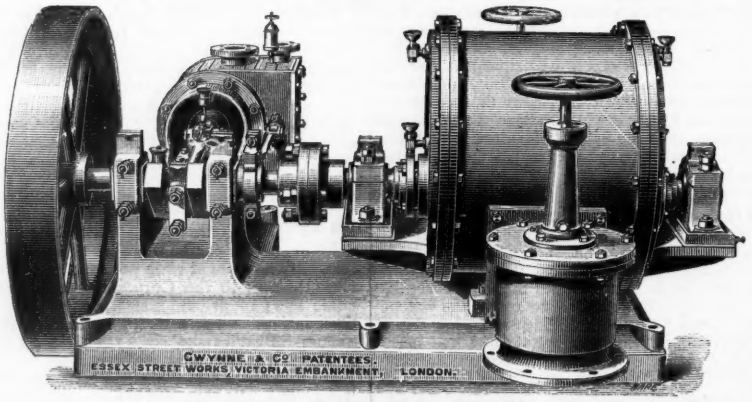

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides ombined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
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Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
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GAS FITTER, lathe and vice, age 30, seeks regular employment. Five years' factory experience.
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ADVERTISER seeks a situation as CLERK or ASSISTANT in a Gas Company's office. Very good references.
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ADVERTISER, with good experience in Sanitary and Gas Engineering, &c., desires a position in a Firm of Engineers in London as MANAGER or UNDER MANAGER, with view to possible partnership.
Reply, with particulars, to No. 2116, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Re-engagement as WORKING MANAGER or FOREMAN, practically experienced in Carbonizing, Engines and Exhausters, Fitting, Main and Service Laying, Index Reading, and the General Routine of Gas-Works. Unexceptionable references. Total abstainer.
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ADVERTISER, aged 20, holding first-class Honours Certificate "Gas Manufacture," and at present engaged in small works, requires situation as ASSISTANT to ENGINEER of a works where he would be able to extend his knowledge of design and construction of works. Good testimonials. Knowledge of shorthand. Nominal wages expected.
Address No. 2125, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a thoroughly competent GAS ANALYST. Age from 21 to 25. Previous experience at a Gas-Works indispensable.
Apply, with references, by letter, to No. 2124, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a competent Man to manage the Gas-Works in a country village. Good House and Garden. Would be allowed to do Fitting on his own account.
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WANTED, by a Gas Company in the South of England, making 60 millions per annum, a good practical WORKING FOREMAN. Must have a good knowledge of the manufacture and distribution of Gas in all its branches, and be a good Mechanic. Wages 32s. a week, with Cottage.
Applications to be sent to No. 2123, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Newcastle and Gateshead Gas Company require an ASSISTANT MANAGER or GENERAL FOREMAN for their Gateshead Works, where the largest make is about 4 millions a day. He must be capable of taking the entire management of the Works in the absence of the Manager, and have a good general knowledge in all departments.
Applications, in own handwriting, with three recent testimonials of character and ability, and stating age, where now employed, when at liberty, and salary expected, to be addressed to the Chairman, Gas Office, Newcastle-on-Tyne, not later than the 1st day of August.
W. HARDIE, Secretary.
June 27, 1892.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
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*** See Advertisement p. III., centre of JOURNAL.
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WANTED, for a Works making about 15 Millions, a steady MAN. Must have practical knowledge of Carbonizing, Fitting, and the general Routine of a Gas-Works. House, Coal, and Gas free.
Address, giving particulars, and stating age and wages required, to Mr. J. REEDS, Gas Company, MATLOCK BATH.

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WANTED, a Working Manager for the Thurso Gas-Works, N.B. Annual make, about 3 millions, with 200 consumers.
Applicant must be competent as a Stoker, and in the Carbonization and Distribution of Gas in all its branches. He will be required to enter upon his duties on the 1st of October next.
Wages, £80 per annum, with good House and Garden, Coal, and Gas free.
Applications to be sent in (with testimonials of recent date) not later than the 3rd of August next, addressed to
SAMUEL DAY, Secretary.
Gas Office, Ravensthorpe, near Dewsbury, Yorks., July 22, 1892.

WOOD Grid Making Plant for Sale.
Particulars on application to No. 2121, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TRANSACTIONS from 1863 to 1890 of the Society of Engineers. 28 Vols. Perfect copies and little used; equal to new. Price 10 Guineas.
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FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
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THE Royal Agricultural Hall Company, Limited, Islington, have FOR SALE one 500-LIGHT DRY METER, and one 200-LIGHT DRY METER, which until recently have been used at the Hall, and are in good working order.
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FOR SALE, together or in part—A small GAS PLANT, suitable for small Town, Factory, or Mansion. Holder, 25 ft. by 10 ft.; Two Purifiers, 5 ft. by 3 ft. by 3 ft.; 300-Light Meter, &c.
Apply to Mr. S. DAWES, Clevedon, SOMERSET.

TENDERS FOR COAL.

THE Eccleshill and Bolton Gas Company invite TENDERS for 2000 tons of GAS COAL, to be delivered at the Railway Station (G.N.R.) in Twelve Months, in such quantities, from time to time, as may be required.
Endorsed tenders must reach me not later than Monday morning, the 8th of August.
J. MELLOR, Secretary.
Eccleshill, near Bradford, July 22, 1892.

TENDERS FOR COAL.

THE Broadstairs Gas Company invite TENDERS for the supply of 2500 tons of the best NEWCASTLE GAS COAL, to be delivered in good condition into Carts provided by the Company in Broadstairs Harbour, or f.o.b. Vessels in the Tyne, from August, 1892, to July, 1893.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed tenders, endorsed "Tender for Coal and Freight," or for "Coal," to be sent in on or before Tuesday, Aug. 2, 1892, addressed to the Chairman of the Company.
Further particulars can be obtained of the undersigned.
W. J. LATCHFORD, Secretary and Manager.
Gas Offices, Broadstairs, July 9, 1892.

TENDERS FOR FREIGHT.

THE Broadstairs Gas Company invite TENDERS for the FREIGHT of 2500 tons of COAL from the Tyne to Broadstairs Harbour, delivered into Carts provided by the Company, from August, 1892, to July, 1893.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed tenders, endorsed "Tender for Freight," to be sent in on or before Tuesday, Aug. 2, 1892, addressed to the Chairman of the Company.
Further particulars can be obtained of the undersigned.
W. J. LATCHFORD, Secretary and Manager.
Gas Offices, Broadstairs, July 9, 1892.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

THE Ibstock Gas Company require at once a CLERK OF WORKS for a few months, to superintend the construction of a Gasholder Tank.

Apply, stating wages required, to Mr. J. W. HOPKINS, Secretary, Ibstock, near ASHBY-DE-LA-ZOUCH.

TO COAL OWNERS.

THE Directors of The Gaslight and Coke Company are prepared to receive TENDERS for the supply of 1,500,000 tons, more or less, of COAL, for a period of Ten months from the 1st day of September next, in accordance with the terms of their Specifications.

Deliveries can be made either by Ship in the Thames or by the principal Lines of Railway, which are in connection with the several Works of the Company.

Copies of the Specifications and Forms of Tender can be obtained upon application at this Office; and all tenders must be sent in before Noon on Wednesday, the 3rd of August, addressed to me, and endorsed "Coal Tender."

By order,
JOHN ORWELL PHILLIPS,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., July 13, 1892.

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the SUPPLY of about 49,000 tons of CANNEL and about 160,000 tons of best GAS COALS (screened or nuts). Price per ton to be quoted, delivered at their Gas-Works, Meadow Lane (Hunslet Lane Siding), New Wortley (Gelderd Junction Siding), or at the Gas-Works, York Street, in such quantities as may be required.

The contract to commence the 1st of October next, and terminate June 30, 1893

Forms of tender may be obtained on application to Mr. Lupton, Gas Department, Municipal Offices, Calverley Street.

Tenders may be for any portion of the total quantity required, and will be received not later than Wednesday, the 17th of August next, addressed to the Chairman of the Gas Committee, Municipal Offices, Calverley Street, and endorsed "Tender for Coal."

The lowest or any tender will not necessarily be accepted.

CITY OF BELFAST.

THE Gas Committee of the Belfast Corporation invite TENDERS for the supply and erection of IRON and STEEL WORK in connection with new Stage Floor Retort-House and Benches.

Drawings and Specification may be inspected at the Engineer's Office, Gas-Works, Belfast.

Copy of Specification, with Form of Tender attached, can be had on payment of One Guinea, to be returned on receipt of a *bond fide* tender.

For the convenience of parties unable to inspect Plans at the Works, it has been arranged to supply a complete set of Drawings and Specification on payment of Three Guineas (not returnable).

Tenders, endorsed "Tender for Iron and Steel Work, Retort-House," must be lodged in the Town Clerk's Office, Town Hall, Belfast, not later than Wednesday, the 10th of August, 1892.

The Committee do not bind themselves to accept the lowest or any offer.

JAMES STELFOX,
Engineer.

TENDERS FOR GAS COAL.

THE Directors of the Exmouth Gas Company invite TENDERS for the supply of about 2000 tons of clean, dry, unscreened, fresh wrought GAS COAL.

Tenders to be for price f.o.b.; also price delivered free at Exmouth Docks, between the 1st of August next and the 30th of June, 1893, accompanied by working analysis.

Sealed tenders, addressed to the Chairman, and endorsed "Tender for Coal," to be delivered to the Company's Office not later than Saturday, July 30, 1892.

No tender necessarily accepted.

By order,
JAMES T. FOSTER,
Secretary.

Gas-Works, Exmouth,
July 5, 1892.

UXBRIDGE & HILLINGDON GAS CONSUMERS' COMPANY.

TAR AND AMMONIACAL LIQUOR.

THE Directors are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the ensuing Twelve Months from the 1st of September next.

The quantity of Tar will be about 35,000 gallons, and the quantity of Liquor will be between 800 and 900 butts, both of which will be delivered free into Contractor's Barges alongside the Works, on the Grand Junction Canal.

Tenders, endorsed for Tar or Liquor (as the case may be), must be addressed to the Chairman, and be delivered at the Company's Offices, High Street, Uxbridge, not later than Saturday evening, Aug. 6.

The Company have no special form of tender; but it is suggested that the Tar should be tendered for at so much per gallon, and the Ammoniacal Liquor at so much per ounce per butt—the strength being ascertained by Wills's distillation test.

The Directors do not bind themselves to accept the highest or any tender.

Further particulars may be obtained of the undersigned.

S. PENNY, Assoc.M.Inst.C.E.,
Engineer and Manager.

Uxbridge, Middlesex,
July 22, 1892.

SOUTH METROPOLITAN GAS COMPANY.

NOTICE is hereby given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Bridge House Hotel, London Bridge, in the Borough of Southwark, on Wednesday, the 17th day of August next, at Two o'clock in the afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ending the 30th day of June last, and to declare a Dividend for the same period.

The Transfer Books will be closed from the 3rd day of August until after the meeting.

By order,
FRANK BUSH,
Secretary.

Offices: 709A, Old Kent Road, S.E.,
July 22, 1892.

TENDERS FOR GAS COAL.

THE Directors of the Kildwick Parish Gas Company invite TENDERS for the supply of 2500 tons of the best screened or unscreened GAS COAL, to be delivered during the Year ending July 31, 1893, in the Gas Company's Siding, Kildwick.

Tenders, sealed and endorsed "Gas Coals," specifying the description of the Coals, and the name of the Pit from which the Coals are to be supplied, may be sent in to me not later than Monday, Aug. 1, 1892.

FRED. H. PICKLES,
Manager and Secretary.

Gas-Works, Kildwick,
July 18, 1892.

THE Corporation of Middleton are prepared to receive TENDERS for the supply of 6500 tons of COAL and 2000 tons of CANNEL, delivered at the Middleton Railway Station, in such quantities and at such times as the Corporation or their Gas Manager may require.

Sealed tenders, addressed to the Chairman of the Gas Committee, to be delivered, at my Office, on or before Wednesday, the 3rd day of August, 1892, endorsed "Tender for Coal" or "Cannel."

Further particulars may be obtained by written application only to Mr. T. Duxbury, Gas Manager.

The Corporation do not bind themselves to accept the lowest or any tender.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton,
near Manchester, July 22, 1892.

BOROUGH OF DEWSBURY.

THE Lighting and Water Committee of the above Corporation invite TENDERS for the supply and delivery during the Twelve Months ending the 31st day of August, 1893, of:—

1. SULPHURIC ACID.
2. WET AND DRY GAS-METERS.
3. CAST-IRON GAS AND WATER PIPES.

Specifications and Forms of Tender may be obtained on application to the Gas Engineer, Mr. Charles A. Craven, Gas-Works, Savile Town, Dewsbury.

Tenders, under sealed covers, endorsed "Sulphuric Acid," "Meters," or "Cast-Iron Pipes," as the case may be, to be sent to me not later than Saturday, the 6th day of August next.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
E. MAWDESLEY,
Town Clerk.

Town Hall, Dewsbury,
July 26, 1892.

WEST MALLING GAS COMPANY.

TENDERS FOR GAS COAL.

TENDERS are invited for the supply of about 550 tons (more or less) of PELTON MAIN or any other class of really good GAS COAL, to be delivered at the Company's Works, West Malling, between the 29th day of September, 1892, and the 29th day of September, 1893, in quantities of not more than 50 tons a month.

The name and quality of the coal to be specified in the tender.

Terms: Payments quarterly.

Sealed tenders, endorsed "Tender for Coal," to be forwarded to the Secretary, on or before Thursday, the 11th day of August next.

The Directors do not pledge themselves to accept the lowest or any tender.

By order,
HENRY D. WILDES,
Secretary.

West Malling,
July 18, 1892.

CONTRACT FOR GAS COALS.

NOTICE is hereby given that the Local Board for the District of the Town of Horncastle, in the County of Lincoln, are prepared to receive TENDERS for the supply of from 500 to 1800 tons of best screened SILKSTONE GAS NUTS, to be delivered by the 30th of June, 1893, in such quantities and at such times as the Board may direct. The Coal to be sent in a dry condition, free from Hards, Smudge, Dirt, Shale, Pyrites, or other Impurities.

Sealed tenders, marked "Tender for Gas Coal," to be sent to the Chairman of the Board, Mr. John Panton, High Street, Horncastle, on or before the 29th day of July, 1892.

The Board do not bind themselves to accept the lowest or any tender.

By order,
CHARLES DEE,
Clerk to the Board.

Horncastle, July 15, 1892.

WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

NOTICE is hereby given that the next ORDINARY GENERAL MEETING of the Proprietors of the above Company will be held at the Company's Offices, North Street, Wandsworth, on Thursday, the 11th of August next, at Five o'clock in the Evening precisely, for the purpose of a Declaration of a Dividend, and the transaction of the General Business of the Company.

The Transfer Books will be closed on and from the 25th of July till the 11th of August, both days inclusive.

By order of the Board,
W. CROMARTY,
Secretary.

Offices: North Street, Wandsworth, S.W.,
July 20, 1892.

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THE

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AND OTHER PAPERS

CHIEFLY RELATING TO

STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.

BY

F. SOUTHWELL CRIPPS, Assoc. M. Inst.C.E.

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CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works
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PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

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Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from

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SILICA BLOCKS, BRICKS, AND CEMENT
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Strongly recommended where EXCESSIVE HEATS have to be maintained.

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For particulars, price, &c., apply to Mr E. PRICE, Inventor and Patentee, 22, Alwyne Road Canonbury, LONDON, N.
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Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

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56, ROBERTSON STREET, GLASGOW.

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REAL OLD SILKSTONE GAS COAL,
Address THE STRAFFORD COLLIERIES COMPANY,
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PATENTEE OF
A Special Compound for the cure of Stopped Ascension-Pipes. A couple of charges will clear a stopped Pipe, and an occasional charge keeps them clean; also increases the Make per ton and the Illuminating Power.
Prices and Particulars on Application. HEAD OFFICES: CORPORATION STREET, BIRMINGHAM. TELEGRAPHIC ADDRESS: "EVESON, BIRMINGHAM."
THE WATERBLEAN COLOR AND MINING COMPANY, MILLOM, CUMBERLAND.
TELEGRAPHIC ADDRESS: "WATERBLEAN MINES, MILLOM." PORTERAGE, 1s. 6d.
VENETIAN AND OXIDE REDS for the Manufacture of ANTI-CORROSIVE PAINTS.
Specially adapted for the Ironwork of Gas-Works and wherever subject to exposure.
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ORDERS TO BIRMINGHAM, OR DIRECT TO THE MINES.

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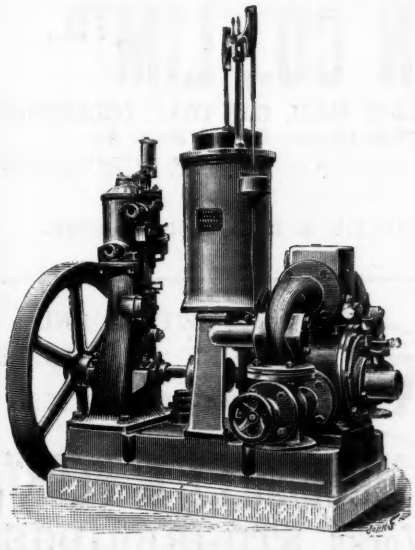
Illustrated Pamphlet and Terms on application to J. E. FISHER, Stourbridge, Agent for England and Wales; to C. M. HAMILTON, Portland Place, Hamilton, Agent for Scotland and Ireland; and for all other Countries to the Patentee,
Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.



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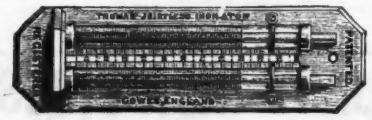
Prices and Analysis of all the Scotch Cannels on application.



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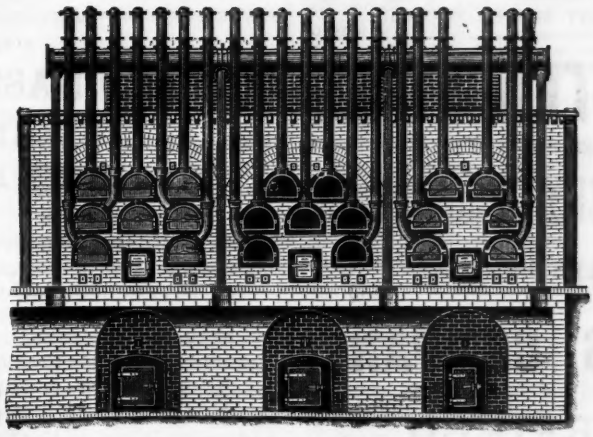

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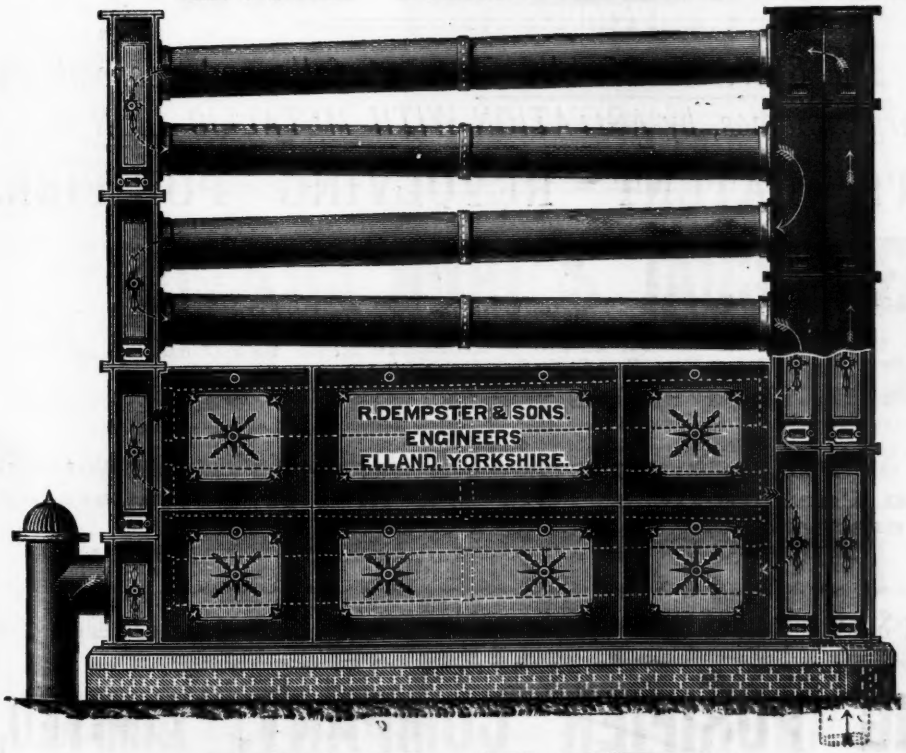

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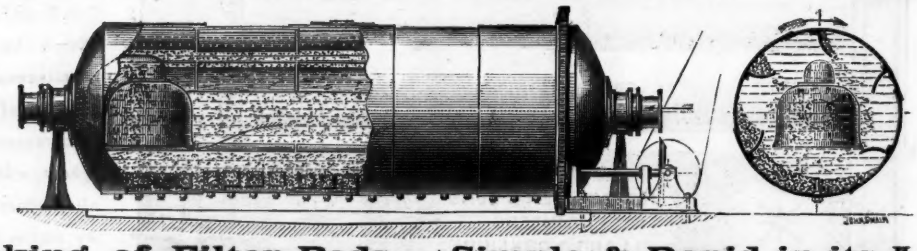

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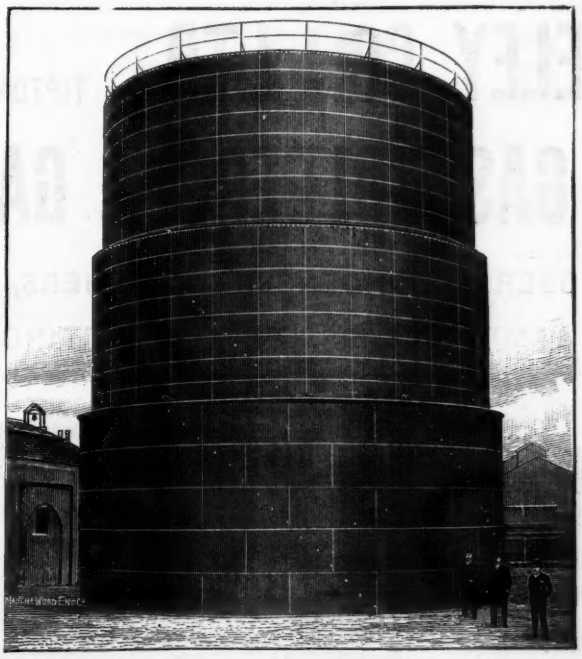

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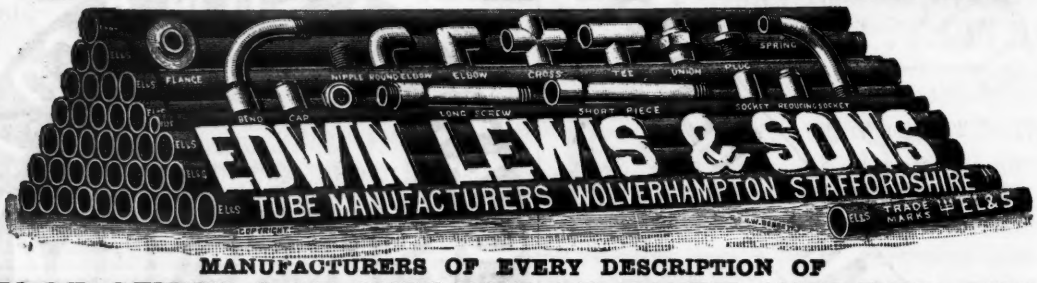

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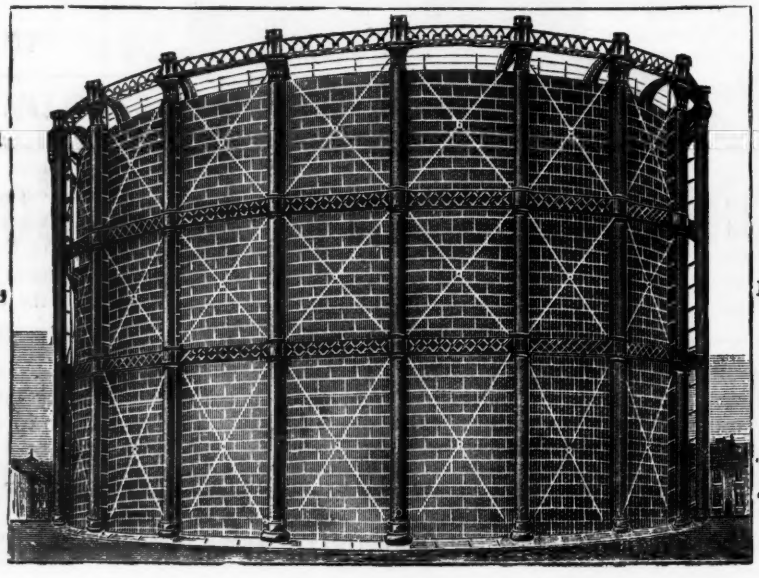

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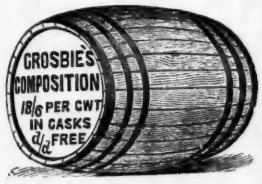

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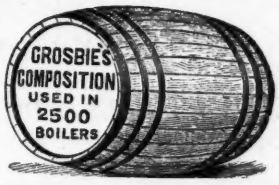

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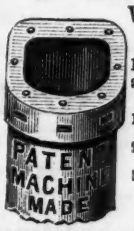

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Gives a powerful top heat.

Double Grill of simplest and most efficient kind.

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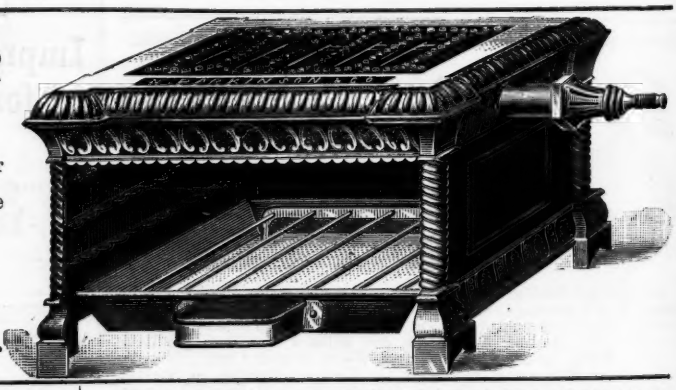

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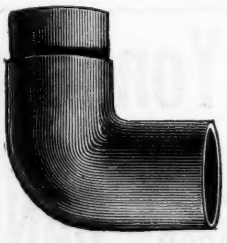

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[See also Advt., p. 148.

London: Printed by WALTER KING (at the office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, July 26, 1892.